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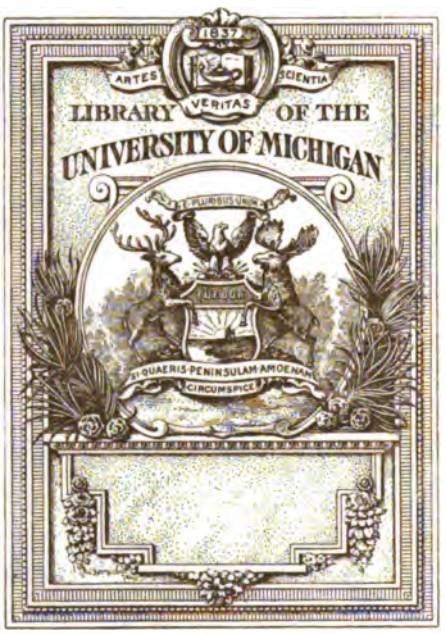
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NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

Membership of

.....

Application Received

Notice to Members.

To make the Cotton Manufacturers' Association an absolutely representative body it must include as many as possible of those who are eligible for membership. It has been found that many who were eligible and desired to join had not done so because not invited. It is hoped that every member will present the matter to non-members among his associates. The accompaning blank proposition for membership can be detached from the cover at the row of perforations.

NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

Membership of

.....

Application Received

.....189 .

Action by Board of Government,.....*favorable.*

..... 189 .

Voted by the Association,.....*elected,*

.....189 .

New England Cotton Manufacturers' Associati

Founded April 20, 1865. Incorporated December 1, 1894.

ROOM 501 JOHN HANCOCK BUILDING,

No. 178 Devonshire Street, and No. 35 Federal Stree

PROPOSAL FOR MEMBERSHIP.

(When filled out, to be mailed to the Secretary, P. O. Box 3672, Boston, Mass., in time for action by the Board of Government, at least one week before a meeting of the Association.)

Mr. .....

Position, ...

P. O. Address, ...

is proposed for ..... *membership in the* NEW ENGLAND COTTON
active or associate

MANUFACTURERS' ASSOCIATION *by* .....
signature of member proposing candidate.

a member of the Association.

Experience of Applicant, (Please state, in full, particulars of detail, giving names, dates, and nature of work, as fully as convenient.)

.....

The undersigned certifies that the above statements are correct, and agrees that, if elected to the Association, he will be governed by its rules as long as his connection with it shall continue.

Date, ... 189 .

signature of candidate.

TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 64.

ANNUAL MEETING.

HELD AT CHIPMAN HALL, TREMONT TEMPLE, BOSTON, MASS, APRIL 27-28, 1898.

Office of the Association:
501 John Hancock Building, No. 178 Devonshire St., and No. 35 Federal St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF E. L. BARRY,
1898.

Entered according to Act of Congress
in the Year 1898
By the New England Cotton Manufacturers' Association,
in the Office of The Librarian of Congress
at Washington.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy to non-members. The price of this issue and the one previous is $1.00 each to members, and the prices of copies previous to Volume 63, is 50 cents to members, but each member is entitled to a copy as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts.

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

Now, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,
Secretary of the Commonwealth.

137064

Commonwealth of Massachusetts.

(Acts of 1895, Chap. 163.)

AN ACT TO AUTHORIZE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION TO HOLD ITS MEETINGS WITHOUT THE COMMONWEALTH.

Be it enacted, etc., as follows:

SECTION 1. The New England Cotton Manufacturers' Association is hereby authorized to hold its meetings in any state or territory of the United States and in the District of Columbia; provided, however, that its annual meeting shall be held in this Commonwealth at least once in five years.

SECT. 2. This act shall take effect upon its passage. [Approved March 23, 1895.]

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED APRIL 20, 1865.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars. Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may accept such resignation; and any member may be expelled for cause,

at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2, excepting that this class of membership does not carry with it the privilege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

ARTICLE 5. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 6. The officers of this Association shall be a President, two Vice-Presidents, six Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 7. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and two Directors; the President and Vice-Presidents to serve one year, and the two Directors shall be chosen for terms of three years.

DUTIES OF OFFICERS.

ARTICLE 8. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 9. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 10. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 11. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of

their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 12. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

MEETINGS.

ARTICLE 13. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 14. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meetings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 15. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided*, notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

BOARD OF GOVERNMENT.

1898.

PRESIDENT.

STEPHEN A. KNIGHT, ... PROVIDENCE, R. I.

VICE-PRESIDENTS.

FRED C. McDUFFIE, ... LAWRENCE, MASS.
HENRY T. WHITIN, ... NORTHBRIDGE, MASS.

DIRECTORS.

ALBERT F. KNIGHT, ... QUIDNICK, R. I.
JOHN ECCLES, ... TAFTVILLE, CONN.
GEORGE H. HILLS, ... FALL RIVER, MASS.
CHAS. H. RICHARDSON, . . . CLINTON, MASS.
JOHN TEMPEST MEATS, . . . TAUNTON, MASS.
GEORGE F. WHITTEN, . . . MANCHESTER, N. H.

AUDITOR.

J. HERBERT SAWYER, ... BOSTON, MASS.

SECRETARY.

C. J. H. WOODBURY, P. O. Box 3672, BOSTON, MASS.

OFFICE OF THE ASSOCIATION:

ROOM 501, JOHN HANCOCK BUILDING, 178 DEVONSHIRE STREET,
BOSTON, MASS.

OFFICERS OF THE ASSOCIATION,

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Walter E. Parker,	1889–92
Amos D. Lockwood,	1878–80	Robert McArthur,	1892–94
John Kilburn,	1880–83	Edw. W. Thomas,	1894–95
William C. Lovering,	1883–85	A. M. Goodale,	1895–96
Richard Garsed,	1885–86	Arthur H. Lowe,	1896–97
J. S. Ludlam,	1886–88	Russell W. Eaton,	1897–98
Henry F. Lippitt,	1888–89	STEPHEN A. KNIGHT,	1898–

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Walter E. Parker,	1885–89
William A. Burke,	1865–73	Richard B. Borden,	1886–88
John C. Palfrey,	1873–76	Arnold B. Sanford,	1888–91
Edward Atkinson,	1876–78	Robert McArthur,	1889–92
A. G. Cumnock,	1877–80	Simeon B. Chase,	1891–93
Charles Nourse,	1878–81	E. W. Thomas,	1892–94
William F. Goulding,	1880–83	A. M. Goodale,	1893-95
Richard Garsed,	1881–85	William J. Kent,	1894–97
J. S. Ludlam,	1883–86	FRED. C. McDUFFIE,	1895–
		HENRY T. WHITIN,	1897–

DIRECTORS.

J. S. Davis,	1865–69	A. M. Wade,	1868–69
Charles Nourse,	1865–78	D. J. Johnston,	1869–70
Phineas Adams,	1865–74	A. G. Cumnock,	1869–77
William P. Haines,	1865–69	F. E. Clarke,	1869–75

DIRECTORS.—Concluded.

Thomas J. Borden,	1865–78	Robert McArthur,	1886–89
Daniel D. Crombie,	1865–68	S. S. Spencer,	1887–90
Cyrus I. Barker,	1875–80	E. W. Thomas,	1888–92
Hervey Kent,	1877–81	William W. Whitin,	1888–93
David J. Johnston,	1878–82	Robert R. Smith,	1889–92
Walter Paine, 3d,	1878–80	Alfred M. Goodale,	1890–93
Chas. L. Lovering,	1878–83	William J. Kent,	1891–94
Richard Garsed,	1880–81	Herman F. Straw,	1891–93
William H. Jennings,	1880–83	Fred C. McDuffie,	1892–95
Chas. D. McDuffie,	1881–83	George W. Bean,	1892–95
Walter E. Parker,	1881–85	F. M. Messenger,	1893–95
John W. Danielson,	1881–85	Arthur H. Lowe,	1894-96
William E. Barrows,	1882–83	Henry T. Whitin,	1894–97
Rufus A. Maxfield,	1883–86	Herbert L. Pratt,	1895–98
George W. Weeks,	1883–86	Russell W. Eaton,	1896–97
Henry S. Howe,	1883–87	ALBERT F. KNIGHT,	1893–
Richard B. Borden,	1883–86	JOHN ECCLES,	1895–
O. S. Brown,	1885–91	STEPHEN A. KNIGHT,	1895–
Henry F. Lippitt,	1885–88	C. H. RICHARDSON,	1897–
Wilbur A. Stiles,	1886–88	GEORGE H. HILLS,	1897–
Stephen N. Bourne,	1886–91	JOHN T. MEATS,	1898–
John Kilburn,	1870–80	GEO. F. WHITTEN,	1898–
William P. Haines,	1874–78		

AUDITORS.

Benjamin Saunders,	1865–71	Henry D. Sullivan,	1873–82
John C. Palfrey,	1871–73	J. HERBERT SAWYER,	1882

SECRETARY AND TREASURER.

Ambrose Eastman,	1865–94	C. J. H. WOODBURY,	1894

MEMBERS OF THE ASSOCIATION.

May 1, 1898.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, or any error in regard to their names.

As a number of members rejoined the Association after severing their first membership, the date of their earliest election is given.

HONORARY MEMBERS.

George Arms	Grand Hotel	New York City	Oct. 16, 1872.
Jones S. Davis	6 Newton St.,	Holyoke, Mass.	Oct. 27, 1897.
Ambrose Eastman	53 State St.	Boston, Mass.	Sept. 27, 1894.
Samuel Webber	Hydraulic Engineer	Charlestown, N. H.	Apr. 28, 1897.

ACTIVE MEMBERS.

Alfred E. Adams	Supt. Linwood Mills	Whitinsville, Mass.	Apr. 27, 1887.
John S. Adams, Jr.	Supt. Adams Bros. Mfg. Co. 35 Grove St.,	Adams, Mass.	Apr. 29, 1896.
Stephen L. Adams	Treas. Stafford Mfg. Co.	Central Falls, R. I.	Apr. 24, 1895.
Joseph D. Aiken	Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co. Box 34,	Providence, R. I.	Apr. 28, 1886.
B. A. Alexander	Supt. Boston Duck Co.	Bondsville, Mass.	Apr. 28, 1898.
George E. Ames	Mech. Supt. Lawrence Mfg. Co.	Lowell, Mass.	Apr. 24, 1895.
William Ames	Treas. Fletcher Manufg. Co., Box 83, 47 Charles St.,	Providence, R. I.	Apr. 30, 1879.
Charles B. Amory	Treas. Hamilton Manufg. Co. 70 Kilby St.,	Boston, Mass.	Apr. 25, 1894.
Thomas Armstrong	Supt. No. Pownal Mfg. Co.	No. Pownal, Vt.	Oct. 27, 1897.
John W. Arrington	Treas. & Agt. Edna Cotton Mills	Reidsville, N. C.	Oct. 24, 1895.
Abel T. Atherton		Bay Side, R. I.	Oct. 16, 1872.

Edward Atkinson . . . Prest. Boston Mfrs. Mu. Fire Ins. Co. . . . . .
. . . . . 31 Milk St., Boston, Mass. . . . Apr. 19, 1871.
Edward W. Atkinson . Stoddard, Haserick, Richards & Co. . . . . .
. . . . . 152 Congress St., Boston, Mass. . Oct. 27, 1886.
H. C. Atwood . . . . Treas. Williamsville Manufg. Co. . . Providence, R. I. . . Apr. 29, 1885.
James A. Atwood . . . Agt. Wauregan Mills and Quinebaug Co. . . . . .
. . . . . Wauregan, Conn. . . Oct. 28, 1891.
John Walter Atwood . Supt. Wauregan Mills . . . . . Wauregan, Conn. . . Oct. 24, 1895.
W. E. Atwood . . . . Secy. and Asst. Treas. Williamsville Manufg. Co. . . . . .
. . . . . Killingly, Conn. . . . Sept. 27, 1894.
George A. Ayer . . . Supt. City Manufg. Corporation . . . . . .
. . . . . 123 Fifth St., New Bedford, Mass. . Apr. 24, 1895.

Charles L. Bailey . . . Gen. Supt. Boston Manufg. Co. . . . . .
. . . . . Box 143, Waltham, Mass. . Sept. 27, 1894.
Henry A. Bailey . . . Agt. Chicopee Manufg. Co. . . . . Chicopee Falls, Mass. Oct. 25, 1893.
Edwin H. Baker . . . Bliss, Fabyan & Co., Box 2899 . . . . . .
. . . . . 117 Duane St., New York City, N. Y. Apr. 24, 1878.
Philip S. Baker . . . . Sec. and Treas. Crowders Mountain Cotton Mills . . . .
. . . . . Kings Mt., N. C. . . Oct. 24, 1895.
Edward R. Ballou . . . Supt. Brighton Mills . 540 West 23rd St., New York City . Apr. 25, 1894.
William P. Bancroft . . Vice-Pres. Joseph Bancroft & Sons Co. . . . . .
. . . . . Wilmington, Del. . . Oct. 31, 1883.
A. D. Barker . . . . . Agt. Avon Manufg. Co. . . . . Lewiston, Me. . . . Apr. 19, 1871.
Lewis E. Barnes . . . Agt. Pemberton Co. & Methuen Co., Lawrence, Mass. . . Oct. 24, 1895.
William A. Barrell . . Agt. Lawrence Duck Co. . . . . Lawrence, Mass. . . Apr. 30, 1884.
Edwin N. Bartlett . . . Supt. Sigourney and Rockdale Mills, North Oxford, Mass. . Apr. 29, 1891.
Daniel Moore Bates, Jr. Asst. Supt. Joseph Bancroft & Sons Co., Wilmington, Del. . . Apr. 28, 1898.
Joseph P. Battles . . . Asst. Mgr. Amer. Drosophore Co., Box 1460 . . . . . .
. . . . . 65 Equitable Building, 150 Devonshire St., Boston, Mass. . . . Oct. 24, 1895.
George W. Bean . . . Agt. Androscoggin Mills . . . . . Lewiston, Me. . . . Apr. 17, 1872.
Robert Beatty . . . . Robert Beatty & Co. . . . . .
. . . . . Coral and Adams Sts., Philadelphia, Pa. . . Oct. 27, 1897.
Truman Beckwith . . . Treas. Dyerville Manufg. Co. . Box 171, Providence, R. I. . Apr. 27, 1892.
John Bell . . . . . Asst. Treas. and Mgr. Smith & Dove Manufg. Co. . . . .
. . . . . Andover Mass. . . . Oct. 27, 1897.
A. C. Bent . . . . . Agt. Safety Seamless Pocket Co. . . Taunton, Mass. . . . Oct. 27, 1897.
W. N. Blackstone . . . Treas. Attawaugan Co. . . . . Norwich, Conn. . . . Apr. 29, 1896.
J. H. Blades . . . . . Supt. Lorraine Manufg. Co. . . . . Westerly, R. I. . . . Apr. 28, 1898.
William W. Blades . . Gen. Supt. Lorraine Mfg. Co. . . . Pawtucket, R. I. . . Oct. 25, 1893.
T. Ashby Blythe . . . Proprietor Ashby Cotton Mills . . . . . .
. . . . . 114 Chestnut St., Philadelphia, Pa. . . Oct. 27, 1897.
John P. Bodge . . . . Treas. Arkwright Mills . . . . . Fall River, Mass. . . Oct. 27, 1897.
Nathaniel B. Borden . Treas. Barnard Manufg. Co. . . . . Fall River, Mass. . . Oct. 15, 1873.
Richard B. Borden . { Treas. Richard Borden Mfg. Co. . / Treas. Troy C. & W. Mfg. Co. . . } Fall River, Mass. . . July 18, 1866.

Thomas J. Borden	Pres. Richard Borden Manufg. Co.	Box 118, Fall River, Mass.	Apr. 20, 1865.
E. S. Boss	Agt. Willimantic Linen Co.	Willimantic, Conn.	Oct. 29, 1879.
Stephen N. Bourne	Agt. Stark Mills	Manchester, N. H.	Oct. 21, 1869.
Frank A. Bowen	Supt. Appleton Co.	Lowell, Mass.	Apr. 28, 1897.
Arthur F. Brackett	Supt. Royal Valley & Arctic Mills	Riverpoint, R. I.	Oct. 24, 1895.
A. W. Brainerd	Agt. H. N. Slater Mills	Webster, Mass.	Apr. 28, 1898.
Ernest Bridge	Supt. Jas. Chadwick & Bro. Ltd.	Jersey City, N. J.	Apr. 24, 1895.
Christopher P. Brooks	Director Lowell Textile School	Lowell, Mass.	Apr. 28, 1897.
Henry R. Brown	Supt. Hope Co. and Phenix Mill	Phenix, R. I.	Apr. 28, 1897.
James W. Brown	Agt. Warren Cotton Mills	West Warren, Mass.	Oct. 24, 1895.
O. S. Brown	Agt. Salmon Falls Manufg. Co.	Salmon Falls, N. H.	Apr. 21, 1875.
Thomas J. Brown	George Brown's Sons	Mt. Joy, Penn.	Oct. 27, 1897.
E. C. Bucklin	Treas. Interlaken Mills, Treas. Harris Mfg. Co.	Box 289, Providence, R. I.	Apr. 25, 1883.
Robert Burgess	Supt. Pierce Mfg. Corp.	New Bedford, Mass.	Apr. 27, 1892.
Edward N. Burke	Lowell Machine Shop	Lowell, Mass.	Apr. 28, 1880.
W. R. Burnham	Treas. Uncasville Manufg. Co.	Norwich, Conn.	Apr. 29, 1885.
William D. Cadwell	Agt. Nashua Mfg. Co. & Jackson Co.,	Nashua, N. H.	Apr. 19, 1871.
John P. Campbell	Supt. New York Mills,	New York Mills, Oneida Co., N. Y.,	Sept. 22, 1896.
Byron F. Card	Agt. Howland Mills	New Bedford, Mass.	Apr. 25, 1888.
Arnold B. Chace, Jr.	Agt. Valley Falls Co. Woonsocket Mills	Valley Falls, R. I.	Apr. 24, 1895.
George A. Chace	Treas. Bourne Mills	Fall River, Mass.	Apr. 25, 1877.
H. S. Chadwick	Pres. Dover Yarn Mill Pres. Dilling Cotton Mills	204 S. Tryon St., Charlotte, N. C.	Apr. 24, 1895.
Simeon B. Chase	Treas. King Philip Mills	Fall River, Mass.	Apr. 21, 1875.
Clarence N. Childs	Asst. Supt. Hamilton Manufg. Co.	43 Pine St., Lowell, Mass.	Apr. 24, 1895.
Elmer G. Childs	Agt. Boston Duck Co.	Bondsville, Mass.	Oct. 26, 1892.
Jno. H. C. Church	Asst. Treas and Sec. Monument Mills,	Gt. Barrington, Mass.	Apr. 28, 1897.
Alfred Clarke	Chief Eng'r. and Gen. Supt. Eastern Elec. Light and Storage Battery Co.	Box 406, Lowell, Mass.	Apr. 30, 1879.
Ernest E. Clark	H. N. Slater Mills	Webster, Mass.	Apr. 29, 1896.
Frederick E. Clarke		Lawrence, Mass.	Apr. 20, 1865.
George A. Clark	Supt. Manchester Mills	Manchester, N. H.	Oct. 25, 1882.
E. N. Clemence	Sec. and Treas. Eagle & Phenix Mfg. Co. and Agt. for Receivers	Columbus, Ga.	Apr. 28, 1897.
W. H. Cloher, Jr.	Treas. Utica Cotton Co.	Capron, Oneida Co., N. Y.	Sept. 22, 1896.
Alonzo A. Coburn	Treas. Atherton Machine Co.	Lowell, Mass.	Apr. 25, 1888.
Josiah G. Coburn		Newton, Mass.	Apr. 20, 1865.
John A. Collins	Supt. American Linen Co.	73 Cottage St., Fall River, Mass.	Oct. 31, 1883.
Frank B. Comins	Vice-Pres. U. S. Aerophor Air Moistening and Ventilating Co.	P. O. Box 1555 Providence, R. I.	Oct. 28, 1891.
John J. Connell	Supt. Cohannet Mills	Taunton, Mass.	Apr. 27, 1892.

Alphonse S. Covel	Treas. Tremont and Suffolk Mills	P. O. Box 1716, 7 Kilby St., Boston, Mass.	Oct. 31, 1877.
P. T. Creed	Supt. Hopewell Mills	Box 356, Taunton, Mass.	Sept. 22, 1896.
John B. Cudlip	Supt. Gibson Cotton Mills	Marysville, N. Bruns.	Apr. 28, 1897.
H. H. Culver	Supt. Elizabeth Poole Mill	Taunton, Mass.	Apr. 28, 1897.
Henry S. Culver	Supt. Westville Cotton Mill	Taunton, Mass.	Apr. 28, 1897.
A. G. Cumnock	Agt. Boott Cotton Mills	Lowell, Mass.	Oct. 28, 1885.
Andrew J. Currier	Mgr. Albion and Valley Falls Co.	Valley Falls, R. I.	Apr. 25, 1888.
T. B. Dallas	Treas. Phœnix Cotton Mills Treas. Dallas Manufg. Co.	Nashville, Tenn. Box 8386	Oct. 24, 1895.
Woodbury K. Dana	Treas. Dana Warp Mills	Westbrook, Me.	Apr. 25, 1888.
Albert W. Danforth	Supt. & Engineer Shanghai Cot. Cloth Co., Shanghai, China	881 Bridge St., Lowell, Mass.	Apr. 27, 1881.
A. Lockwood Danielson	Asst. Treas. Quinebaug Co., Box 900,	Providence, R. I.	Sept. 27, 1894.
J. DeForest Danielson	Asst. Treas. Lockwood Co. & Lewiston Bleachery & Dye Works	Providence, R. I.	Sept. 27, 1894.
John W. Danielson	Treas. Lockwood Co.	Box 900, Providence, R. I.	Jan. 15, 1868.
B. D. Davol	Pres. Barnard Mfg. Co.	P. O. Box 418, Fall River, Mass.	Apr. 25, 1877.
James C. Deane	Supt. Griswoldville Manufg. Co.	Griswoldville, Mass.	Apr. 25, 1894.
George DeForest	Treas. Mohawk Valley Mills Treas. Utica Steam Cotton Mills	Utica, New York	Oct. 27, 1897.
William P. Dempsey	Agt. Dempsey Bleachery and Dye Works,	Pawtucket, R. I.	Apr. 28, 1886.
Charles W. Dennett	Agt. Johnson Manufg. Co. Agt. Dunbar Mills Co.	North Adams, Mass.	Oct. 29, 1890.
Edward P. Dennis	Lowell Machine Shop	Lowell, Mass.	Apr. 25, 1888.
Charles A. Denny	Vice-Pres. and Gen. Mgr. American Card Clothing Co.	Leicester, Mass.	Apr. 25, 1888.
P. Y. DeNormandie	Agt. Potomska Mills	New Bedford, Mass.	Apr. 29, 1896.
Charles Owen Dexter	Mgr. Canadian Col'd Cot Mills, Ltd.	Hamilton, Ont.	Apr. 24, 1895.
F. Dilling	Sec'y & Treas. Dilling Cotton Mills	Kings Mountain, N. C.	Oct. 24, 1895.
Albert W. Dimick	Agt. Indian Head Mills of Alabama,	Cordova, Ala.	Apr. 25, 1894.
Eben S. Draper	Agt. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George A. Draper	Treas. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George Otis Draper	Sec'y Draper Co.	Hopedale, Mass.	Apr. 24, 1895.
William F. Draper	Pres. Draper Co.	Hopedale, Mass.	July 17, 1867.
William F. Draper, Jr.	Draper Co.	Hopedale, Mass.	Oct. 29, 1890.
John Drowne	Supt. Cocheco Mfg. Co.	Dover, N. H.	Apr. 29, 1896.
Joseph M. Dunham	Supt. Merrick Thread Co.	190 Walnut St., Holyoke, Mass.	Oct. 26, 1892.
David H. Dyer	Mill Engineer	7 and 8 Pocassett Bank Building, Fall River, Mass.	Oct. 18, 1871.
William A. Eastman	Treas. Lowell Hosiery Co.	Lowell, Mass.	Apr. 24, 1878.
Russell W. Eaton	Agt. Cabot Manufg. Co.	Brunswick, Me.	Oct. 26, 1887.
John Eccles	Supt. Ponemah Mills	Taftville, Conn.	Apr. 27, 1892.

D. M. Ehrlich	Treas. Galveston Cotton Mills	Galveston, Texas	Ap.. 24, 1895.
Lawrence V. Elder		Dickinson, Texas	Oct. 27, 1886.
Oscar Elsas	Vice-Pres. Fulton Bag & Cotton Mills, P. O. Box 773,	Atlanta, Ga.	Apr. 28, 1897.
Frederick W. Ely	Agt. Columbian Manufg. Co.	Greenville, N. H.	Apr. 25, 1888.
H. B. Estes	Agt. Continental Mills	Lewiston, Me.	Apr. 26, 1893.
William Evans	Supt. Richard Borden Mfg. Co.	Fall River, Mass.	Apr. 29, 1896.
C. E. Falls	Sec. and Treas. Enterprise Mills	Kings Mountain, N. C.	Oct. 24, 1895.
Herbert R. Farnum	Supt. Bernon Mills	Georgiaville, R. I.	Apr. 27, 1881.
Charles F. Farrar	Supt. Wm. A. Slater Mills Corp.	Slatersville, R. I.	Oct. 27, 1897.
Frank S. Field	Supt. & Agt. Massaemit Yarn Mills	Shattuckville, Mass.	Oct. 24, 1895.
William Firth	Mgr. Am. Drosophore Co. 150 Devonshire St.,	Boston, Mass.	Apr. 25, 1888.
Charles H. Fish	Agt. Cocheco Manufg. Co.	Dover, N. H.	Apr. 27, 1887.
Henry E. Fisher	Vice-Pres. & Agt. Atlanta Cotton Mills	Atlanta, Ga.	Oct. 24, 1895.
Herbert Fisher		Taunton, Mass.	Oct. 29, 1879.
William B. Fittz	Supt. West Boylston Manufg. Co.	Oakdale, Mass.	Oct. 26, 1892.
Frederick A. Flather	Mech. Engineer & Foreman Lowell Machine Shop	Lowell, Mass.	Apr. 29, 1891.
M. F. Foster		Milford, N. H.	Apr. 17, 1872.
Philip H. Fowler		Gloucester City, N. J.	Nov. 30, 1881.
Edward W. France	Dir. of Philadelphia Textile School, Broad and Pine Streets,	Philadelphia, Pa.	Sept. 22, 1896.
C. H. Frisbie	Agt. Attawaugan Co.	Norwich, Conn.	Oct. 29, 1890.
W. T. Galey	Pres. Aberfoyle Manufg. Co.	Chester, Pa.	Apr. 28, 1897.
William Gammell	Agt. Berkeley Co.	Providence, R. I.	Oct. 28, 1885.
James G. Garland		Biddeford, Me.	Oct. 29, 1879.
Edward T. Garsed	Treas. Hucomuga Mills	Greensboro, N. C.	Apr. 28, 1898.
Joshua Garsed	Wingohocking, Mills, Frankford	Philadelphia, Pa.	Oct. 27, 1897.
James A. Gary	Pres. Gary Manufg. Co. 108 W. German St.,	Baltimore, Md.	Apr. 25, 1883.
James Gee	Mgr. Interlaken Dye Works	Fiskville, R. I.	Apr. 28, 1898.
Charles E. Getchell	Supt. Waltham Bleachery and Dye Works 35 Willow St.,	Waltham, Mass.	Oct. 30, 1889.
Daniel Gilligan	Supt. Pocasset and Metacomet Mills,	Fall River, Mass.	Apr. 29, 1896.
William C. Godfrey	Agt. Indian Orchard Co.	Indian Orchard, Mass.	Oct. 29, 1890.
Alfred M. Goodale	Treas. Boston Manufg. Co. 50 State St.,	Boston, Mass.	Apr. 25, 1883.
Charles H. Gorton	Agt. Glenark Knitting Co.	Woonsocket, R. I.	Apr. 25, 1894.
Marcellus Gould	Agt. Falls Company	Norwich, Conn.	Sept. 22, 1896.
William B. Gowdey	Mill Supplies 40 Clifford St. Box 707,	Providence, R. I.	Apr. 30, 1890.
George P. Grant, Jr.	Treas. Grant Yarn Co.	Fitchburg, Mass.	Sept. 27, 1894.
D. W. Gray	Supt. Skenandoa Cotton Co.	Utica, N. Y.	Oct. 26, 1892.

R. A. Gray	Supt. Rodman Manufg. Co.	Allenton, R. I.	Apr. 24, 1895.
Stephen Greene	Mill Architect and Engineer	131 Devonshire St., Boston, Mass.	Oct. 27, 1886.
William C. Greene	Gen. Mgr. Peace Dale Manufg. Co.	Peace Dale, R. I.	Oct. 27, 1886.
Joseph Warren Greene	Supt. Hamilton Web Co.	Hamilton, R. I.	Apr. 29, 1896.
John Gregson	Supt. Merchants Manufg. Co.	Fall River, Mass.	Apr 24, 1895.
Maxwell Grierson	Gn. Mgr. Jas. Chadwick & Bro., Ltd.,	Jersey City, N. J.	Apr. 28, 1898.
Frederick Grinnell	Pres. Gen. Fire Extinguisher Co.	New Bedford, Mass.	Apr. 24, 1878.
David Grove	Supt. Dyerville Manufg. Co.	610 Manton Ave., Providence, R. I.	Apr. 28, 1898.
H. S. Grove	Pres. and Gen. Mgr. Argo Mills	Philadelphia, Pa.	Apr. 28, 1898.
Arthur H. Gulliver	Asst. Supt. Lonsdale Co.	Ashton, R. I.	Apr. 24, 1889.
B. F. Guy	Gen. Supt. Pelzer Manufg. Co.	Pelzer, S. C.	Apr. 24, 1895.
Frank J. Hale	Agt. Saco and Pettee Machine Shops	Newton Upper Falls, Mass.	Apr. 27, 1892.
Samuel Hale	Vice-Pres. and Gen. Manager Dixie Cotton Mills	La Grange, Ga.	Apr. 29, 1891.
William E. Hall	Treas. Shaw Stocking Co.	Lowell, Mass.	Apr. 27, 1892.
Z. D. Hall	Supt. Berkshire Cotton Mfg. Co.	P. O. Box 963, Adams, Mass.	Oct. 29, 1879.
John H. Hambly	Treas. Quidnick Manufg. Co.	49 Westminster St., Providence, R. I.	Apr. 24, 1895.
A. M. Hamilton	Supt. Parker Mills	Fall River, Mass.	Apr. 28, 1897.
John F. Hamlet		P. O. Box 160, Fall River, Mass.	Oct. 31, 1888.
Joseph O. Hannum	Agt. Saratoga Victory Manufg. Co.	Victory Mills, Saratoga Co., N. Y.	Apr. 30, 1890.
Frank Harris	Hamlet Mills	Woonsocket, R. I.	Apr. 24, 1889.
Henry F. Harris	Treas. West Boylston Manufg. Co.	340 Main St., Worcester, Mass.	Apr. 30, 1890.
John J. Hart	Charlton Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Samuel E. Hathaway	Supt. Fall River Iron Works Co.	Fall River, Mass.	Sept. 27, 1894.
William Hathaway	Supt. Barnard Manufg. Co.	Fall River, Mass.	Apr. 25, 1894.
William B. Hawes	Treas. No. Dighton Cotton Co.	Fall River, Mass.	Oct. 24, 1895.
Alfred Hawkesworth	Supt. Merchants Cotton Co.	Montreal, P. Q.	Apr. 26, 1893.
Fred Hawkesworth	Asst. Supt. Merchants Cotton Co.	Montreal, P. Q.	Sept. 22, 1896.
Horace L. Hayden		Braintree, Mass.	Apr. 24, 1895.
William Hayes	Agt. Barker Mill	Auburn, Me.	Apr. 30, 1879.
W. G. Henderson	Agt. Shetucket Co.	Norwich, Conn.	Apr. 29, 1896.
James G. Hill		749 Merrimack St., Lowell, Mass.	Jan. 15, 1868.
William R. Hill	Treas. Glasgow Manufg. Co.	South Hadley Falls, Mass.	Oct. 25, 1893.
George H. Hills	Treas. Davol Mills & Stephens Mfg. Co.	Fall River. Mass.	Oct. 24, 1895.
Charles H. Hobbs	Agt. Thorndike Co.	Thorndike, Mass.	Apr. 28, 1886.
Louis L. Hohn	Supt. Wm. Clark Thread Co.,	122 High St., Westerly, R. I.	Apr. 28, 1897.
John Holland	12 Trackey St.	P. O. Box 96, Dover, N. H.	Oct. 31, 1877.

Gideon F. Holmes	Treas. and Gen. Mgr. Plymouth Cordage Co.	No. Plymouth, Mass.	Oct. 30, 1889.
George W. Holt	Agt. Monohansett Manufg. Co.	Putnam, Conn.	Oct. 29, 1879.
William P. Holt	Agt. William A. Slater Mills Corp.	Box 315, Slatersville, R. I.	Oct. 25, 1893.
George L. Hooper		7 Belmont St., Lowell, Mass.	Apr. 27, 1892.
Jno. Hopkinson	Gen. Mgr. Slayden & Kirksey Woolen Mills	Waco, Texas	Apr. 25, 1883.
Thomas Horsfield	Supt. Hargrave's Mills	465 Warren St., Fall River, Mass.	Oct. 27, 1897.
Henry S. Houghton, Jr.	Supt. Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 24, 1895.
W. C. Houston, Jr.	Pres. Hope Mills Manufg. Co.	333 Drexel Building, Philadelphia, Pa.	Apr. 28, 1897.
Elisha H. Howard	Agt. Harris Manufg. Co.	Providence, R. I.	Apr. 25, 1883.
Henry S. Howe	Dry Goods Commissioner,	68 Chauncy St., Boston, Mass.	Oct. 31, 1877.
Albert C. Hoy	Asst. Supt. Hamlet Mills	Woonsocket, R. I.	Apr. 28, 1898.
W. S. Hume	Supt. Dominion Cotton Mills, Ltd.	Hochelaga, P. Q., Can.	Oct. 29, 1890.
Arthur W. Hunking	Agt. Mass. Mills, in Georgia	Lindale, Floyd County, Ga.	Apr. 24, 1895.
D. Edwin Irving	Treas. The Irving & Leiper Mfg. Co.,	Chester, Pa.	Oct. 27, 1897.
J. E. Jenckes	Treas. E. Jenckes Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
David L. Jewell	Agt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 20, 1865.
C. W. Johnston	Treas. The Highland Park Mfg. Co.,	Charlotte, N. C.	Apr. 28, 1898.
David S. Johnston	Treas. Cohoes Iron Foundry & Mach. Co.,	Cohoes, N. Y.	Oct. 28, 1891.
W. T. Jordan	Mgr. Mountain Island Mfg. Co.	Mountain Island, N. C.	Oct. 24, 1895.
Frank E. Kaley	Treas. Morse & Kaley Mfg. Co.	Milford, N. H.	Oct. 24, 1895.
W. E. Keach	Supt. Grant Yarn Co.	Fitchburg, Mass.	Oct. 26, 1892.
Roland R. Kelly	Supt. Williamstown Manufg. Co.	Williamstown Sta., Mass.	Nov. 30, 1881.
Joseph H. Kendrick	Agt. American Supply Co.	Box 850, Providence, R. I.	Apr. 30, 1879.
George E. Kent	Gen. Mgr. Exeter Manufg. Co.	Pittsfield, N. H.	Oct. 31, 1888.
Hervey Kent	Pres. Exeter Manufg. Co.	Exeter, N. H.	Apr. 20, 1865.
Nathaniel B. Kerr	Agt. Grinnell Manufg. Corp.	New Bedford, Mass.	Oct. 26, 1892.
John Kilburn		Belmont, Mass.	Apr. 20, 1865.
Harry W. Kimball		Kingston, Ontario, Can.	Oct. 24, 1895.
John M. Kimball	Agt. Slatersville Mills Special Atty. Jewett City Mills	4 Market Square, Providence, R. I.	Oct. 31, 1888.
Benjamin B. Kirk	Supt. Shove Mills	P. O. Box 140, 2107 South Main St., Fall River, Mass.	Apr. 28, 1897.
Albert Knight	Supt. Quidnick Mills	Quidnick, R. I.	Apr. 24, 1895.
Albert F. Knight		Quidnick, R. I.	Oct. 27, 1886.
Jesse A. Knight	Supt. Harris Textile Co.	Phenix, R. I.	Oct. 26, 1892.
Stephen A. Knight	Agt. Hebron Manufg. Co.	Box 820, Providence, R. I.	Oct. 21, 1868.
Walter B. Knight	Reynolds Manufg. Co.	Davisville, R. I.	Apr. 24, 1889.

Fred Lacey	Supt. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 24, 1895.
William T. Lang	Agt. Brookside Mills	Knoxville, Tenn.	Apr. 28, 1897.
Walter H. Langshaw	Supt. Dartmouth Manufg. Corp.	New Bedford, Mass.	Apr. 29, 1896.
Elliott Cowdin Lambert	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 24, 1895.
George H. Law	Supt. Bristol Manufg. Corp.	64 Willis St., New Bedford, Mass.	Apr. 28, 1897.
Abbott F. Lawrence	Treas. Nemasket Mills	Box 848, Taunton, Mass.	Apr. 24, 1895.
Harold Lawton	Gen. Mgr. Warwick Mills	Centreville, R. I.	Oct. 27, 1886.
Evan Arthur Leigh	Textile Machinery	70 Kilby St., Boston, Mass.	Oct. 29, 1890.
John Leiper	Supt. Fitchburg Manufg. Co.	W. Fitchburg, Mass.	Oct. 27, 1897.
J. Colby Lewis	Supt. W. A. Slater Mills Corp.	Jewett City, Ct.	Oct. 26, 1892.
Leontine Lincoln	Pres. Seaconnet Mills	Fall River, Mass.	Apr. 28, 1897.
B. F. G. Linnell		P. O. Box 645, Central Falls, R. I.	Oct. 27, 1897.
Charles Warren Lippitt,	Treas. Silver Spring B. & D. Co.	Providence, R. I.	Oct. 30, 1878.
Henry F. Lippitt	Agt. Social and Manville Cos.	Providence, R. I.	Apr. 27, 1881.
William H. Loftus	Supt. Clark Thread Co.	Newark, N. J.	Oct. 27, 1897.
Robert W. Lord	Agt. R. W. Lord & Co.	Kennebunk, Me.	Oct. 20, 1869.
Ernest Lovering	Agt. Lyman Mills	Holyoke, Mass.	Apr. 25, 1888.
Henry M. Lovering	Agt. Whittenton Manufg. Co.	Taunton, Mass.	Oct. 27, 1880.
William M. Lovering	Supt. Whittenton Manufg. Co.	Taunton, Mass.	Sept. 27, 1894.
Arthur H. Lowe	Treas. Parkhill Manufg. Co.	Fitchburg, Mass.	Oct. 30, 1889.
David Lowe	Asst. Supt. Parkhill Manufg. Co.	Fitchburg, Mass.	Apr. 24, 1895.
Dudley T. Lyall	Asst. Mgr. Brighton Mills	541 W. 23d St., N. Y.	Sept. 22, 1896.
William L. Lyall	Supt. J. & W. Lyall Loom and Machine Works	540 W. 23d St., New York City	Oct. 26, 1892.
Herbert Lyman	Treas. Hadley Co.	95 Milk St., Boston, Mass.	Oct. 24, 1895.
Otis G. Lynch	Supt. Enterprise Manufg. Co.	Augusta, Ga.	Oct. 24, 1895.
Alvin S. Lyon	Supt. Lowell Manufg. Co.	Lowell, Mass.	Apr. 26, 1882.
James R. MacColl	Treas. Lorraine Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Charles L. Macomber	Agt. Nemasket Mills	Taunton, Mass.	Apr. 24, 1895.
Charles T. Main	Mech. and Mill Engineer	Exchange Bldg., Boston, Mass.	Oct. 28, 1885.
Charles R. Makepeace	Mill Engineer	Box 973, Providence, R. I.	Apr. 30, 1890.
A. T. Malcolmson	Asst. Supt. Wm. A. Slater Mills Corp.,	Jewett City, Conn.	Oct. 27, 1897.
Arthur B. Mann	J. H. Martin & Co., Box 465, 99 Franklin St.,	New York	Apr. 25, 1894.
Charles H. Manning	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Henry F. Mansfield	Supt. Utica Steam Cotton Mills and Mohawk Valley Cotton Mills	Utica, N. Y.	Apr. 30, 1890.
Paul J. Marrs	Treas. Henderson Cotton Mills	Henderson, Ky.	Oct. 27, 1897.
Albert G. Martin	Supt. Kincaid Manufg. Co.	Box 272, Griffin, Spalding County, Ga.	Apr. 30, 1884.
Henry D. Martin	Mgr. Dominion Cotton Mills Co. Ltd.	Windsor, N. S.	Apr. 28, 1897.
Ira J. Martin	Supt. Bozrahville Co., 62 Conant St.,	Pawtucket, R. I.	Oct. 26, 1892.
John R. Mason	Supt. Laurel Lake Mills	439 Middle St., Fall River, Mass.	Apr. 28, 1897.

Philip A. Mathewson	Supt. King Philip Mills	Box 607, Fall River, Mass.	Apr. 24, 1895.
Thomas Mayor	Textile Machinery	Thomas Mayor & Son, 26 Olney St., Providence, R. I.	Oct. 27, 1880.
Robert McArthur	Agt. Pepperell and Laconia Cos.	Biddeford, Me.	Apr. 17, 1872.
Charles D. McDuffie	Agt. Manchester Mills	Manchester, N. H.	Apr. 21, 1869.
Fred C. McDuffie	Treas. Everett Mills and York Manufg. Co.	Box 2963 Boston, Mass.	Oct. 25, 1882.
William G. McLoon	Supt. Barnaby Manufg. Co.	Fall River, Mass.	Apr. 27, 1892.
William P. McMullan	Agt. Naumkeag Steam Cotton Co.	Salem, Mass.	Sept. 27, 1894.
John Tempest Meats	Gen. Supt. Mason Machine Works	Taunton, Mass.	Apr. 27, 1887.
George A. Mebane	Sec. and Treas. Asheville Cotton Mills Pres. Spray Cotton Mills	Asheville, N. C. Spray, N. C.	Apr. 28, 1898.
Charles H. Merriman, Jr.	Supt. Globe Mill	Woonsocket, R. I.	Apr. 24, 1895.
Frank M. Messenger	Agt. Grosvenor Dale Co.	No. Grosvenor Dale, Conn.	Apr. 27, 1887.
W. H. Miles	Agt. Farwell Mills	Lisbon, Me.	Sept. 22, 1896.
James I. Milliken	Agt. Everett Mills	Lawrence, Mass.	Oct. 26, 1892.
Roscoe S. Milliken	Supt. Pemberton Co.	19 Albion St., Lawrence, Mass.	Apr. 29, 1896.
David Milne	C. J. Milne & Sons	Washington Ave. & 11th St., Philadelphia, Pa.	Apr. 28, 1897.
A. B. Mole	Mgr. Greylock Mill	Adams, Mass.	Apr. 24, 1895.
Edward A. Mongeon	Supt. Blackstone Manufg. Co.	Blackstone, Mass.	Apr. 24, 1895.
Fred W. Moore	Agt. Cordis Mills	Millbury, Mass.	Apr. 27, 1892.
Albert H. Morton	Supt. Kitson Machine Co.	Lowell, Mass.	Oct. 28, 1891.
Fred S. Mosher	Supt. Henrietta Mills	Henrietta, Rutherford Co., N. C.	Oct. 24, 1895.
Oliver H. Moulton	Supt. Hamilton Manufg. Co.	Lowell, Mass.	Apr. 20, 1865.
Farquharson J. Muir	Supt. Canadian Col. Cot. Mills Co. Ltd.	Hamilton, Ont., Can.	Apr. 27, 1892.
William B. Munroe		Garwood, N. J.	Oct. 24, 1895.
Roscius C. Newell	Supt. Palmer Mill	Three Rivers, Mass.	Oct. 24, 1895.
William G. Nichols	Supt. Lancaster Mills	Clinton, Mass.	Oct. 25, 1893.
Franklin Nourse	Agt. Lawrence Manufg. Co.	Lowell, Mass.	Apr. 24, 1878.
S. Odenheimer	Treas. Lane Mills	New Orleans, La.	Oct. 25, 1893.
Charles K. Oliver	Treas. Columbia Mills Co.	Columbia, S. C.	Sept. 27, 1894.
Warren M. Orswell	Pres. Orswell and Nockege Mills	Fitchburg, Mass.	Apr. 16, 1873.
J. Edward Osborn	Treas. American Linen Co.	Fall River, Mass.	Apr. 28, 1897.
Oscar L. Owen	Mech. and Mill Eng. Whitin Machine Works	Whitinsville, Mass.	Apr. 25, 1894.
Elmer E. Page	Agt. York Manufg. Co.	Saco, Me.	Apr. 27, 1892.
Francis J. Parker	Treas. Monadnock Mills, 27 Kilby St.,	Boston, Mass.	Jan. 15, 1868.
O. B. Parker	Supt. U. S. Cotton Co.	Central Falls, R. I.	Apr. 24, 1895.
Samuel L. Parker	Supt. Turners Falls Cotton Mills	Box 627, Turners Falls, Mass.	Apr. 29, 1896.

Walter E. Parker	Agt. Pacific Mills, 217 Haverhill St.,	Lawrence, Mass.	Apr. 25, 1877.
John H. Parks	Pres. Wm. Parks & Son, Ltd.	St. John, N. B.	Apr. 24, 1878.
Duncan D. Parmly	Treas. Johnson Mfg. Co. and Dunbar Mills Co.	49 Wall St., New York, N. Y.	Sept. 22, 1896.
John W. Pead	Agt. Merrimack Manufg. Co.	Box 1231, Lowell, Mass.	Apr. 26, 1893.
James R. Pearce	Supt. Edna Cotton Mills	Reidsville, N. C.	Oct. 24, 1895.
William C. Peirce	Pres. Elizabeth Mills,	564 Eddy St., Providence, R. I.	Apr. 24, 1895.
William D. Pennell	Agt. Hill Manufg. Co.	Lewiston, Me.	Apr. 16, 1873.
Haven C. Perham	Treas. Kitson Machine Co.	Lowell, Mass.	Apr. 30, 1879.
Henry C. Phillips	New York Mills	New York	Apr. 25, 1894.
Andrew G. Pierce, Jr.	Treas. Wamsutta Mills Treas. Pierce Manufg. Corp. Treas. Howland Mills Corp.	New Bedford, Mass.	Apr. 24, 1895.
Moses Pierce	Pres. Aspinook Co.	274 Broadway, Norwich, Conn.	Oct. 30, 1878.
Reuben Pilling, Jr.	Supt. Granite Mills Co.	Greenville, R. I.	Apr. 29, 1896.
Charles H. Plummer	Agt. Great Falls Manufg. Co.	Somersworth, N. H.	Apr. 25, 1888.
Charles T. Plunkett	Sec. Berkshire Cotton Mfg. Co.	Adams, Mass.	Apr. 28, 1897.
Herbert L. Pratt	Agt. Bates Manufg. Co.	Lewiston, Me.	Oct. 27, 1875.
T. W. Pratt	Pres. West Huntsville Cotton Mills Co.	Huntsville, Ala.	Sept. 22, 1896
John E. Prest	Gen. Supt. Harmony Mills	Cohoes, N. Y.	Apr. 17, 1872.
M. W. Quinn	Agt. Hamilton Woolen Co.	Amesbury, Mass.	Oct. 27, 1886.
T. G. Ramsdell	Agt. Monument Mills	Housatonic, Mass.	Oct. 30, 1878.
M. A. Rawlinson	Supt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 24, 1895.
Robert Redford	Agt. Arlington Mills	Lawrence, Mass.	Apr. 26, 1882.
R. S. Reinhardt	Treas. Elm Grove Cotton Mills	Lincolnton, N. C.	Apr. 28, 1898.
James Renfrew	Treas. Renfrew Manufg. Co.	Adams, Mass.	Oct. 18, 1871.
Roscoe C. Reynolds	Agt. Lewiston Machine Co.	Lewiston, Me.	Oct. 25, 1876.
F. H. Rice	Holbrook Mills	Box 47, West Boylston, Mass.	Apr. 28, 1880.
Charles H. Richardson	Agt. Lancaster Mills	Clinton, Mass.	Apr. 24, 1889.
C. T. Richmond	Mgr. Fustian Dept. Crompton Co.	Crompton, R. I.	Apr. 28, 1897.
W. H. Richmond	Supt. Bibb Mill No. 2	Macon, Ga.	Oct. 27, 1897.
C. W. Rider	Treas. Merrick Thread Co.	Holyoke, Mass.	Apr. 29, 1896.
Charles E. Riley	Textile Machinery	Box 2815 281 Congress St., Boston, Mass.	Apr. 25, 1888.
George W. Robbins	Supt. Barry Cotton Mill	Smithville, Barre, Mass.	Apr. 28, 1897.
Charles D. Robinson	Supt. Crompton Co.	Crompton, R. I.	Sept. 27, 1894.
William A. Robinson	Asst. Supt. Social Manufg. Co.	Woonsocket, R. I.	Apr. 29, 1896.
John K. Russell	Gen. Mgr. May's Landing Water P. Co. and Millville Manufg. Co.	Millville, N. J.	Apr. 29, 1891.

Arnold B. Sanford	226 Devonshire St.,	Boston, Mass.	Oct. 25, 1882.
Charles Henry Savage	Supt. Manville Co.	Manville, R. I.	Apr. 26, 1893.
Henry B. Sawyer	Asst. Treas. Newmarket Mfg. Co. 45 Milk St.,	Boston, Mass.	Oct. 27, 1897.
J. Herbert Sawyer	Treas. Newmarket Manufg. Co. Box 2966, 45 Milk St.,	Boston, Mass.	July 19, 1865.
F. C. Sayles	Pres. Ponemah Mills	Pawtucket, R. I.	Oct. 27, 1897.
George H. Sayward	Mgr. Standard Yarn Co.	Oswego, N. Y.	Oct. 29, 1890.
Arnold Schaer	Supt. Warren Manufg. Co.	Warren, R. I.	Apr. 24, 1895.
John Scott	Supt. Willimantic Linen Co.	Willimantic, Conn.	Oct. 29, 1879.
Charles M. Sears	Agt. Atlantic Cotton Mills	Lawrence, Mass.	Apr. 28, 1898.
George H. Shapley	Mgr. Silver Lake Co., 78 Chauncy St.,	Boston, Mass.	Apr. 29, 1896.
Frank P. Sheldon	Mill Engineer	Providence, R. I.	Apr. 25, 1894.
Thomas C. Sheldon	Agt. Fitchburg Duck Mills	Fitchburg, Mass.	Oct. 29, 1884.
Willis S. Shepard	Pres. American Net and Twine Co. 93 Commercial St.,	Boston, Mass.	Apr. 29, 1896.
William F. Sherman	P. O. Box 206,	Lawrence, Mass.	Apr. 15, 1874.
Charles M. Shove	Treas. Granite Mills Box 45,	Fall River, Mass.	Oct. 27, 1875.
Herbert H. Shumway	Treas. Corr Manufg. Co.	Taunton, Mass.	Apr. 26, 1893.
Francis H. Silsbee	Supt. Cotton Dept. Pacific Mills	Lawrence, Mass.	Apr. 27, 1887.
N. G. Simonds	Treas. Naumkeag Steam Cotton Co.,	Salem, Mass.	Apr. 28, 1898.
Louis Simpson	Gen. Mgr. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 24, 1895.
Abbott E. Slade	Treas. Laurel Lake Mills	Fall River, Mass.	Oct. 25, 1893.
Arba C. Slater	Supt. Linwood Mills	Linwood, Mass.	Jan. 15, 1868.
Arthur T. Smith	Supt. Langley Manufg Co. Supt. Aiken Manufg. Co.	Langley, S. C.	Oct. 24, 1895.
Joel Smith	Supt. The J. P. King Manufg. Co. Supt. Aiken Manufg. Co.	Augusta, Ga. Bath, S. C.	Oct. 24, 1895.
J. C. Smith	Supt. Chace Mills	Fall River, Mass.	Oct. 27, 1897.
James Herbert Smith	Supt. Quinebaug Co.	Danielson, Conn.	Apr. 28, 1898.
Robert R. Smith	Mgr. Greenwoods Co.	New Hartford, Conn.	Oct. 19, 1870.
William O. Smith	Agt. Easthampton Spinning Co.	Easthampton, Mass.	Apr. 28, 1897.
Ellison A. Smyth	Pres. Pelzer Manufg. Co.	Pelzer, S. C.	Oct. 26, 1892.
William S. Southworth	Agt. Mass. Cotton Mills Box 1230,	Lowell, Mass.	Oct. 31, 1888.
William T. Spear	Supt. Jackson Co.	Nashua, N. H.	Oct. 30, 1889.
S. S. Spencer	Supt. Conestogo Steam Mills	Lancaster, Pa.	Oct. 25, 1876.
Wilton H. Spencer	Textile Manuf., 7 Exchange Pl.,	Providence, R. I.	Apr. 28, 1898.
George E. Spofford	Supt. Readville Cotton Mills	Readville, Mass.	Apr. 29, 1896.
Leroy Springs	Pres. Lancaster Cotton Mills	Lancaster, S. C.	Oct. 24, 1895.
George R. Stearns	Pres. Riverside Mills	Augusta, Ga.	Apr. 30, 1890.
Walter F. Stiles	Treas. Orswell Mills	Fitchburg, Mass.	Oct. 24, 1895.
O. W. Stites		Hoosick Falls, N. Y.	Oct. 24, 1895.
Herman F. Straw	Agt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Walter H. Summersby	Supt. Pontiac Mill and Bleachery	Pontiac, R. I.	Oct. 25, 1893.
Albert A. Sweet	Supt. King Philip Mills 36 Rockland St.,	Fall River, Mass.	Apr. 26, 1893.
James O. Sweet	Agt. and Treas. Ashland Cotton Co.	Jewett City, Conn.	Apr. 28, 1886.

Edward P. Taft	Treas. Ponemah Mills	Box 1443, Providence, R. I.	Oct. 28, 1885.
Robert Rennie Taft	Supt. Baltic Power Co.	Baltic, Conn.	Apr. 24, 1895.
Robert W. Taft	Treas. Coventry Co.	Box 1144, Providence, R. I.	Sept. 27, 1894.
George P. Taylor		Clinton, Mass.	Oct. 27, 1880.
James W. Taylor	Supt. Canoe River Mills	Box 46, Taunton, Mass.	Oct. 26, 1892.
W. Marshall Taylor	Supt. The Wm. Clark Co.	69 Mechanic St., Westerly, R. I.	Sept. 22, 1896.
Richard Thackeray	Supt. Weetamoe Mills	Fall River, Mass.	Apr. 29, 1885.
Earl A. Thissell	Woonsocket Bobbin Co.	Woonsocket, R. I.	Oct. 30, 1878.
Ariel C. Thomas	Supt. Clinton Manufg. Co.	93 Clinton St., Woonsocket, R. I.	Oct. 31, 1888.
Charles E. Thomas	Treas. Forestdale Manufg. Co.	Woonsocket, R. I.	Oct. 31, 1883.
Edward W. Thomas	Agt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 30, 1884.
Ralph E. Thomson	Supt. Parkhill Manufg. Co.	Fitchburg, Mass.	Apr. 25, 1894.
D. M. Thompson	Pres. & Treas. Corliss Steam Engine Co.	Providence, R. I.	Oct. 28, 1885.
James P. Tolman	Pres. Samson Cordage Works	115 Congress St., Boston, Mass.	Oct. 29, 1890.
D. A. Tompkins	Pres. Atherton Mills	Charlotte, N. C.	Oct. 24, 1895.
George W. Towne	Supt. Cotton Dept. Arlington Mills	Lawrence, Mass.	Oct. 26, 1892.
William E. Trainer	Pres. Linwood Mills	Trainer, Penn.	Apr. 21, 1875.
Robert B. Treat	Centerville Cotton Mills	Centerville, R. I.	Sept. 27, 1894.
C. H. Truesdell	Supt. Attawaugan Co.	Killingly, Conn.	Oct. 29, 1884.
Edmund E. Truesdell	Supt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 26, 1876.
Oscar B. Truesdell	Agt. Fiskdale Mills	Fiskdale, Mass.	Oct. 15, 1873.
George F. Tryon	Supt. Conanicut Mills	Fall River, Mass.	Apr. 28, 1897.
George E. Tucker	Agt. Otis Co.	Ware, Mass.	Oct. 24, 1895.
Charles D. Turnbull	Treas. Wm. A. Slater Mills Corp.	The Ludlow, Boston Mass.	Oct. 27, 1897.
William D. Twiss	Supt. Everett Mills	Lawrence, Mass.	April 29, 1896.
Charles T. Upton	Supt. Shaw Stocking Co.	Lowell, Mass.	Apr. 28, 1897.
George A. Vaughan	Supt. The Putnam Manufg. Co.	Putnam, Conn.	Sept. 22, 1896.
Frank P. Vogl	Agt. Monadnock Mills	Claremont, N. H.	Sept. 27, 1894.
Jude C. Wadleigh	Supt. Mass. Cotton Mills	Lowell, Mass.	Oct. 26, 1892.
Herbert E. Walmesley	Agt. Wamsutta Mills	New Bedford, Mass.	Oct. 29, 1890.
Frederick T. Walsh	Agt. Lowell Bleachery & Dye Works,	Lowell, Mass.	Apr. 28, 1897.
James A. Walsh	Agt. Lewiston Bleachery and Dye Works	Lewiston, Me.	Apr. 27, 1892.
Arthur W. Warren	Treas. W. Warren Thread Works	Westfield, Mass.	Apr. 29, 1896.
John Waterman	Treas. Warren Manufg. Co.	Warren, R. I.	Apr. 30, 1884.
Joseph W. Wattles	Manufacturers' Supplies	Canton Junction, Mass.	July 18, 1866.
George W. Weeks		Clinton, Mass.	Apr. 21, 1869.

W. B. Smith Whaley	Pres. Richland Cotton Mills . . . / Granly Cotton Mills, 1328 Main St.	Columbia, S. C.	Apr. 24, 1895.
H. D. Wheat	Pres. and Treas. Gaffney Mfg. Co.	Gaffney, S. C.	Apr. 24, 1895.
Channing Whitaker	Infringement and Patentability of Inventions		
	Lowell Machine Shop	Lowell, Mass.	Oct. 15, 1873.
A. Tenny White	Supt. Manville Co.	Manville, R. I.	Oct. 26, 1887.
Charles D. White	Agt. Uncasville Mfg. Co.	Uncasville, Conn.	Oct. 27, 1897.
Z. L. White	White Bros.	Winchendon, Mass.	Apr. 28, 1897.
Arthur F. Whitin	Pres. Saunders Cotton Mills	Whitinsville, Mass.	Apr. 24, 1895.
Fred B. Whitin	Agt. Uxbridge Cotton Mills	No. Uxbridge, Mass.	Apr. 28, 1897.
Henry T. Whitin	Treas Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 25, 1877.
Alfred N. Whiting	Sec'y and Treas. L. M. Harris Manufg. Co.		
		Oakdale, Mass.	Apr. 21, 1875.
William S. Whitney	Supt. Mech. Depts., Washington Mills Co.,	Lawrence, Mass.	Apr. 24, 1878.
Arthur Whittam	Supt. The Enterprise Cotton Mills	Orangeburg, S. C.	Apr. 28, 1898.
William Whittam, Jr.		Charlotte, N. C.	Apr. 26, 1893.
George F. Whitten	Agt. Amory Mfg. Co.	Manchester, N. H.	Oct. 26, 1892.
John H. Whitten	Supt. Stark Mills	Manchester, N. H.	Apr. 28, 1898.
Edward B. Wilbur	Supt. Newberry Cotton Mills	Newberry, S. C.	Oct. 30, 1889.
Henry M. Wilcox	Treas. John Rhodes Warp Co.	Millbury, Mass.	Apr. 24, 1889.
Eben C. Willey	Supt. Manchaug Co.	Manchaug, Mass.	Apr. 29, 1896.
Theop. W. Wilmarth	Supt. Millbury Cotton Mills	Millbury, Mass.	Oct. 31, 1883.
Thomas Wilmarth	Supt. Saunders Cotton Mills	Saundersville, Mass.	Apr. 21, 1875.
J. P. Wilson	Treas. Dover Yarn Mills	Charlotte, N. C.	Oct. 24, 1895.
A. S. Winslow		Worcester, Mass.	Oct. 31, 1888.
George Wood	Pres. and Treas. Millville Manufg. Co.		
		626 Chestnut St., Phila., Pa.	Oct. 16, 1872.
John P. Wood	William Wood & Co.		
		521 No. 22d St., Philadelphia, Pa.	Apr. 28, 1897.
C. J. H. Woodbury	Secretary and Treasurer	Lynn, Mass.	Oct. 29, 1879.
A. A. Young, Jr.	Treas. Jewett City Mills	Jewett City, Conn.	Sept. 27, 1894.
Adelbert R. Young	Supt. Ashland Cotton Co.	Jewett City, Conn.	Apr. 25, 1894.

ASSOCIATE MEMBERS.

Henry Ashworth	Agt. Card Clothing Manufg. Co.	Fall River, Mass.	Apr. 28, 1897.
George R. Babbitt	Pres. American Oil Co.		
		182 So. Water St., Providence, R. I.	Apr. 24, 1895.
D. C. Ball	The American Cotton Co.		
		310 Merchants Exchange, St. Louis, Mo.	Oct. 24, 1895.
George S. Barnum	Secy. and Treas. The Bigelow Co.	New Haven, Conn.	Apr. 24, 1895.
Colin C. Bell	Pres. and Treas. Laminar Fibre Co.	No. Cambridge, Mass.	Apr. 29, 1896.
Frank P. Bennett	Publisher American Wool and Cotton Reporter		
		148 Pearl St., Boston, Mass.	Sept. 22, 1896.

J. Payson Bradley	The Kehew-Bradley Co.	24 Purchase St., Boston, Mass.	Apr. 24, 1895.
J. Frank Braids	Mgr. Grease & Oil Dept., Charles S. Bush Co.	212 Weybosset St., Providence, R. I.	Apr. 28, 1897.
Henry G. Brinckerhoff	N. E. Mgr. Fuel Economizer Co., Box 2654	Room 321, 53 State St., Boston, Mass.	Sept. 22, 1896.
D. Russell Brown	Pres. Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
H. Martin Brown	Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
John H. Burghardt	Page Belting Co.	31 Pearl St., Boston, Mass.	Apr. 24, 1895.
Eugene E. Burnham	Belt Mfr.	168 Broadway, Lawrence, Mass.	Oct. 24, 1895.
Harry W. Butterworth	Sec. H. W. Butterworth & Sons	2417 East York St., Philadelphia, Pa.	Oct. 27, 1897.
James Butterworth	Pres. H. W. Butterworth & Sons Co.	York and Cedar Sts., Philadelphia, Pa.	Apr. 24, 1895.
French Campbell	Commission Merchant	Manchester, N. H.	Oct. 27, 1897.
Malcolm Campbell	Gen. Mgr. Woonsocket Machine and Press Co.	Woonsocket, R. I.	Apr. 24, 1895.
W. W. Carey	Machinery Manufacturer	Lowell, Mass.	Apr. 24, 1895.
Charles H. Child	Treas. Brown Bros. Co.	Box 890, Providence, R. I.	Apr. 24, 1895.
Henry C. Clark	Standard Mill Supply Co.	Providence, R. I.	Apr. 28, 1898.
Peter H. Corr	Cotton and Cotton Yarns and Waste	38 Court St., Taunton, Mass.	Apr. 24, 1895.
Thomas G. Cox	Selling Agt. Mason Machine Works	Box 316, Taunton, Mass.	Apr. 24, 1895.
George Crompton	Treas. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 27, 1897.
Randolph Crompton	Vice-Pres. and Asst. Supt. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 27, 1897.
Frederick I. Dana	Manager. Thomas Phillips Co.	Providence, R. I.	Apr. 24, 1895.
J. F. Dickinson	Treas. South Belting Co.	Atlanta, Ga.	Apr. 29, 1896.
R. H. Deming	Cotton Broker	10 So. Water St., Providence, R. I.	Apr. 24, 1895.
C. E. W. Dow	Mgr. American Bolt Co.	Lowell, Mass.	Apr. 24, 1895.
Frederick A. Downes	Sec. Factory Mutual Fire Insurance Cos.	925 Chestnut St., Philadelphia, Pa.	Oct. 27, 1897.
G. B. Emmons	Pres. Emmons Loom Harness Co.	Box 94, Methuen Mass.	Oct. 24, 1895.
T. C. Entwistle	Cotton Machinery Manufacturer	Lowell, Mass.	Apr. 24, 1895.
L. C. Farnsworth	Farnsworth Card Clothing Co.	Pittsfield, Mass.	Oct. 27, 1897.
D. D. Felton	Treas. S. A. Felton & Son Co.	Manchester, N. H.	Apr. 24, 1895.
John W. Ferguson	Builder and General Contractor	253 Broadway, N. Y., and Paterson, N. J.	Apr. 24, 1895.

J. Herbert Foster . . . Cotton Broker . . . . . Providence, R. I. . . Apr. 24, 1895.
George A. Fuller . . . Mgr. Amer. Card Clothing Co. . . . Providence, R. I. . . Apr. 24, 1895.
Merrill A. Furbush . . Treas. M. A. Furbush & Son Machine Co. . . . . .
. . . . . 224 Market St., Philadelphia, Pa. . . Oct. 27, 1897.
John T. Fyans . . . . Agt. Fyans, Frazer & Blackway . . . . . .
. . . . . 411 Beach St., Fall River, Mass. . . Apr. 28, 1897.

H. P. Garland . . . . Treas. Loom Picker Co. . . . . Biddeford, Me. . . . Oct. 24, 1895.
Royal W. Gates . . . . Josiah Gates & Sons, Belting . . . . . .
. . . . . 307 Market St., Lowell, Mass. . . . Apr. 24, 1895.
Rufus B. Goff . . . . Pres. Standard Mill Supply Co. . . . . .
. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.
William S. Granger . . Prest. Granger Foundry & Machine Co., Providence, R. I. . Apr. 24, 1895.
Henry T. Grant, Jr. . . Pres. Mercantile Mutual Fire Ins. Co. . . . . .
. . . . . Banigan Building, Providence, R. I. . . Oct. 27, 1897.

William L. Haines . . Agt. for Brooks & Doxey, of Manchester, Eng. . . . .
. . . . . 161 Pearl St., Boston, Mass. . . . Apr. 29, 1896.
A. Walter Harris . . . Treas. A. W. Harris Oil Co. . . . . .
. . . . . 326 So. Water St., Providence, R. I. . . Oct. 24, 1895.
Alfred H. Hartley . . Dealer in Oils and Mill Supplies . . . . . .
. . . . . Box 409, Fall River, Mass. . . Oct. 27, 1897.
John H. Haworth . . . Haworth & Watson Mfrs. Paper Tubes . . . . . .
. . . . . for Textile Manufg. 43 Columbus Av., Lowell, Mass. . . . Oct. 24, 1895.
Jerome Hill . . . . . 2233 Park Ave., St. Louis, Mo. . . . Apr. 29, 1896.
Henry A. Holcomb . . . . . Box 249, New Bedford, Mass. . Oct. 24, 1895.
Henry S. Houghton, Sr., Mfr. Grids and Beaters . . . . . .
. . . . . 65 Pond St., Woonsocket, R. I. . Apr. 28, 1897.
Alfred A. Hunting . . Mechanical Engineer . . . . . .
. . . . . 26 Mason St., Salem, Mass. . . . Oct. 27, 1897.
C. H. Hutchins . . . . Pres. Crompton & Knowles Loom Works . . . . . .
. . . . . Worcester, Mass. . . Oct. 24, 1895.
W. L. Hutchins . . . Asst. Mgr. Crompton & Knowles Loom Works . . . . .
. . . . . Providence, R. I. . . Apr. 28, 1898.

David Jackson . . . . Pres. & Mgr. Jackson Patent Shell Roll Co., Pawtucket, R. I. Apr. 24, 1895.

William B. Kehew . . The Kehew-Bradley Co. . 24 Purchase St., Boston, Mass. . Apr. 24, 1895.

Josiah M. Lasell . . . Asst. Treas. Whitin Machine Works, Whitinsville, Mass. . Apr. 24, 1895.
John H. Lorimer . . . Scouring, Dyeing and Drying Machinery . . . . . .
. . . . . Ontario and Lawrence Sts., Philadelphia, Pa. . . Oct. 27, 1897.
Stephen C. Lowe . . . Mill Supplies . . . . 87 Union St., New Bedford, Mass. . Oct. 24, 1895.
George A. Lowry . . . Consulting Eng. Planters' Comp. Co., Boston, Mass. . . . Apr. 28, 1898.

F. H. Maynard	Bus. Mgr. Gen. Fire Extinguisher Co.,	Providence, R. I.	Apr. 24, 1895.
Thomas McAuliffe	Supt. Stevens Manufg. Co.	Fall River, Mass.	Apr. 28, 1898.
H. G. McKerrow	Textile Machinery	31 State St., Boston, Mass.	Sept. 22, 1896.
George H. Meader	Steam Appliances	35 Oliver St., Boston, Mass.	Apr. 24, 1895.
George B. Morison	Selling Agt. Hadley Co.	95 Milk St., Boston, Mass.	Apr. 24, 1895.
William R. Noone	Mfr. Roller and Slasher Cloth	100 Pearl St., Boston, Mass.	Oct. 27, 1897.
Sidney B. Paine	General Electric Co.,	180 Summer St., Boston, Mass.	Apr. 24, 1895.
Arthur Parkinson	Selling Agt. Arabol Mfg. Co.,	13 Gold St., New York, N. Y.	Apr. 28, 1897.
Stephen Minot Pitman	Sec'y Narragansett Mutual Fire Insurance Co.	Box 315, Providence, R. I.	Apr. 24, 1895.
Vladimir P. Polevoy	Agent Great Yaroslovskair Cotton Mill (of Yaroslave), Russia	120 Broadway, N. Y.	Apr. 28, 1897.
Charles A. M. Praray	Chas. A. M. Praray & Co., Mill Architect and Engineer	Banigan Building, Providence, R. I.	Apr. 28, 1897.
Charles F. Randall	Expert in Textiles	Room 350, Tremont Building, Boston, Mass.	Apr. 24, 1895.
Richard H. Rice	Treas. Providence Steam Engine Co. & Rice & Sargent Steam Engine Co.	521 So. Main St. Providence, R. I.	Apr. 24, 1895.
C. E. Roberts	Mgr. Hartford Steam Boiler Insurance & Inspection Co.	125 Milk St., Boston, Mass.	Apr. 24, 1895.
Louis E. Robinson	Sea Island Cotton	Box 1216, 20 Market Square, Providence, R. I.	Oct. 27, 1897.
John M. Russell	Asst. Treas. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 24, 1895.
E. A. Smith	Pres. Charlotte Supply Co.	Charlotte, N. C.	Oct. 24, 1895.
Harry M. Smith	Vice-Pres. Standard Mill Supply Co.	77 Exchange Pl., Box 714, Providence, R. I.	Apr. 28, 1897.
R. Paul Snelling	Treas. Saco and Pettee Machine Shops	Newton Upper Falls, Mass.	Sept. 22, 1896.
Lewis R. Speare	Alden Speare Sons & Co., Oil and Mill Supplies	369 Atlantic Ave., Boston, Mass.	Oct. 24, 1895.
Henry C. Spence	Gen. Mgr. Metallic Drawing Roll Co.	Indian Orchard, Mass.	Apr. 24, 1895.
George W. Stafford	Mgr. Crompton & Knowles Loom Works	Providence, R. I.	Apr. 24, 1895.
James Strang	Selling Agt. Metallic Drawing Roll Co.	123 Hampden St., Indian Orchard, Mass.	Oct. 27, 1897.
William H. Stratton	Asst. Mgr. Factory Insurance Asso.	95 Pearl St., Hartford, Conn.	Apr. 28, 1897.
Daniel J. Sully	Cotton Broker, T. M. Reynolds & Co.,	Providence, R. I.	Apr. 24, 1895.

Cyrus A. Taft . . . . Agt. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Charles F. Taylor . . . Owner & Mgr. Burgess Cop Tube Co., Providence, R. I. . . Apr. 28, 1898.
Winthrop Thayer . . . Pres. Thayer & Co., Incorp. . . . . .
. . . . . 1015 Tremont Bldg., Boston, Mass. . . . Apr. 29, 1896.
A. Curtis Tingley . . . Treas. National Ring Traveler Co. . . . . .
. . . . . 7 Eddy St., Providence, R. I. . . Sept. 22, 1896.
William V. Threlfall . . Selling Agt. Saco and Pettee Machine Shops . . . . . .
. . . . . Biddeford, Me. . . . Apr. 24, 1895.

Frank H. Underwood . Resident Mgr. Dodge Mfg. Co. . . . . .
. . . . . 137 Purchase St., Boston, Mass. . . . Apr. 29, 1896.

Justin A. Ware . . . . Sales Mgr. Crompton & Knowles Loom Works . . . . .
. . . . . Worcester, Mass. . . Oct. 24, 1895.
Walter S. Watson . . . Haworth & Watson, Mfrs. Paper Tubes . . . . . .
. . . . . for Textile Manufg. . Box 996, Lowell, Mass. . . . Oct. 24, 1895.
William R. West . . . Roll Coverer . . 830 Purchase St., New Bedford, Mass. . Sept. 22, 1896.
G. Marston Whitin . . Treas. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Fred A. Wilde . . . . Asst. Mgr. The A. T. Atherton Machine Co. . . . . .
. . . . . Pawtucket, R. I. . . Apr. 28, 1897.

Erving Yale Woolley . Stoddard, Haserick, Richards & Co. . . . . .
. . . . . 152 Congress St., Boston, Mass. . . Apr. 24, 1895.

Honorary Members	4
Active Members	435
Associate Members	96
Total Membership	535

MEMBERS OF THE ASSOCIATION,

May 1, 1898.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Biddeford	James G. Garland	
Biddeford	H. P. Garland	Loom Picker Co.
Biddeford	Robert McArthur	Pepperell & Laconia Cos.
Biddeford	William V. Threlfall	Saco & Pettee Machine Shop.
Brunswick	Russell W. Eaton	Cabot Manufg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	A. D. Barker	Avon Manufg. Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Manufg. Co.
Lewiston	Herbert L. Pratt	Bates Manufg. Co.
Lewiston	Roscoe C. Reynolds	Lewiston Machine Co.
Lewiston	James A. Walsh	Lewiston Bleachery and Dye Works.
Lisbon	W. H. Miles	Farwell Mills.
Saco	Elmer E. Page	York Manufg. Co.
Westbrook	Woodbury K. Dana	Dana Warp Mills.

NEW HAMPSHIRE.

Charlestown	Samuel Webber	Hydraulic Engineer.
Claremont	Frank P. Vogl	Monadnock Mills.
Dover	John Drowne	Cocheco Manufg. Co.
Dover	Charles H. Fish	Cocheco Manufg. Co.
Dover	John Holland	12 Trackey St.
Exeter	Hervey Kent	Exeter Manufg. Co.
Greenville	Frederick W. Ely	Columbian Manufg. Co.

Manchester	Stephen N. Bourne	Stark Mills.
Manchester	French Campbell	Commission Merchant.
Manchester	George A. Clark	Manchester Mills.
Manchester	D. D. Felton	S. A. Felton & Sons Co.
Manchester	Elliott Cowdin Lambert	Amoskeag Manufg. Co.
Manchester	Charles H. Manning	Amoskeag Manufg. Co.
Manchester	Charles D. McDuffie	Manchester Mills.
Manchester	Herman F. Straw	Amoskeag Manufg. Co.
Manchester	George F. Whitten	Amory Manufg. Co.
Manchester	John H. Whitten	Stark Mills.
Milford	M. F. Foster	
Milford	Frank E. Kaley	Morse & Kaley Manufg. Co.
Nashua	William D. Cadwell	Nashua Manufg. Co. & Jackson Co.
Nashua	William T. Spear	Jackson Co.
Pittsfield	George E. Kent	Exeter Manufg. Co.
Salmon Falls	O. S. Brown	Salmon Falls Manufg. Co.
Somersworth	Charles H. Plummer	Great Falls Manufg. Co.
Suncook	David L. Jewell	China, Webster & Pembroke Mills.
Suncook	Edmund E. Truesdell	China, Webster & Pembroke Mills.

VERMONT.

North Pownal	Thomas Armstrong	North Pownal Manufg. Co.

MASSACHUSETTS.

Adams	John S. Adams, Jr.	Adams Bros. Manufg. Co.
Adams	Z. D. Hall	Berkshire Cotton Manufg. Co.
Adams	A. B. Mole	Greylock Mill.
Adams	Charles T. Plunkett	Berkshire Cotton Manufg. Co.
Adams	James Renfrew	Renfrew Manufg. Co.
Amesbury	M. W. Quinn	Hamilton Woolen Co.
Andover	John Bell	Smith & Dove Manufg. Co.
Barre, Smithville	George W. Robbins	Barre Cotton Mill.
Belmont	John Kilburn	
Blackstone	Edward A. Mongeon	Blackstone Manufg. Co.
Bondsville	B. A. Alexander	Boston Duck Co.
Bondsville	Elmer G. Childs	Boston Duck Co.
Boston	Charles B. Amory	Hamilton Manufg. Co.
Boston	Edward Atkinson	Boston Mfrs. Mut. Fire Ins. Co.
Boston	Edward W. Atkinson	Stoddard, Haserick, Richards & Co.
Boston	Joseph P. Battles	American Drosophore Co.
Boston	Frank P. Bennett	American Wool & Cotton Reporter.
Boston	J. Payson Bradley	The Kehew-Bradley Co.
Boston	Henry G. Brinckerhoff	Fuel Economizer Co.

Boston	John H. Burghardt	Page Belting Co.
Boston	Alphonse S. Covel	Tremont & Suffolk Mills.
Boston	Ambrose Eastman	53 State St.
Boston	William Firth	American Drosophore Co.
Boston	Alfred M. Goodale	Boston Manufg. Co.
Boston	Stephen Greene	Mill Architect and Engineer.
Boston	William L. Haines	Brooks & Doxey, Manchester, Eng.
Boston	Henry S. Howe	Dry Goods Commissioner.
Boston	William B. Kehew	The Kehew-Bradley Co.
Boston	Evan Arthur Leigh	Textile Machinery.
Boston	George A. Lowry	Planters' Compress Co.
Boston	Herbert Lyman	Hadley Co.
Boston	Charles T. Main	Mech. Mill Engineer.
Boston	Fred C. McDuffie	Everett Mills & York Manufg. Co.
Boston	H. G. McKerrow	Textile Machinery.
Boston	George H. Meader	Steam Appliances.
Boston	George B. Morison	Hadley Co.
Boston	William R. Noone	Roller and Slasher Cloth.
Boston	Sidney B. Paine	General Electric Co.
Boston	Francis J. Parker	Monadnock Mills.
Boston	Charles F. Randall	Expert in Textiles.
Boston	Charles E. Riley	Textile Machinery.
Boston	C. E. Roberts	Hartford St. Boiler Ins. & Insp. Co
Boston	Arnold B. Sanford	226 Devonshire St.
Boston	Henry B. Sawyer	Newmarket Manufg. Co.
Boston	J. Herbert Sawyer	Newmarket Manufg. Co.
Boston	George H. Shapley	Silver Lake Co.
Boston	Willis S. Shepard	American Net & Twine Co.
Boston	Lewis R. Speare	Alden Speare Sons & Co.
Boston	Winthrop Thayer	Thayer & Co., Incorporated.
Boston	James P. Tolman	Samson Cordage Works.
Boston	Charles D. Turnbull	William A. Slater Mills Corp.
Boston	Frank H. Underwood	Dodge Manufg. Co.
Boston	Erving Yale Woolley	Stoddard, Haserick, Richards & Co.
Braintree	Horace L. Hayden	
Canton Junction	Joseph W. Wattles	Manufacturers' Supplies.
Chicopee Falls	Henry A. Bailey	Chicopee Manufg. Co.
Clinton	William G. Nichols	Lancaster Mills.
Clinton	Charles H. Richardson	Lancaster Mills.
Clinton	George P. Taylor	
Clinton	George W. Weeks	
Easthampton	William O. Smith	Easthampton Spinning Co.
Fall River	F. S. Akin	Cornell Mills.
Fall River	Henry Ashworth	Card Clothing Manufr.
Fall River	John P. Bodge	Arkwright Mills.
Fall River	Nathaniel B. Borden	Barnard Manufg. Co.

Fall River	Richard B. Borden	Troy C. & W. Manufg. Co.
Fall River	Thomas J. Borden	Richard Borden Manufg. Co.
Fall River	George A. Chace	Bourne Mills.
Fall River	Simeon B. Chase	King Phillip Mills.
Fall River	John A. Collins	American Linen Co.
Fall River	B. D. Davol	Barnard Manufg. Co.
Fall River	David H. Dyer	Mill Engineer.
Fall River	William Evans	Richard Borden Manufg. Co.
Fall River	John T. Fyans	Fyans, Frazer & Blackway.
Fall River	Daniel Gilligan	Pocasset & Metacomet Mills.
Fall River	John Gregson	Merchants Mfg. Co.
Fall River	A. M. Hamilton	Parker Mills.
Fall River	John F. Hamlet	P. O. Box 160.
Fall River	Alfred H. Hartley	Oils and Mill Supplies.
Fall River	Samuel E. Hathaway	Fall River Iron Works Co.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	William B. Hawes	North Dighton Cotton Co.
Fall River	George H. Hills	Davol Mills and Stephens Mfg. Co.
Fall River	Thomas Horsfield	Hargrave's Mills.
Fall River	Benjamin B. Kirk	Shove Mills.
Fall River	Leontine Lincoln	Seaconnet Mills.
Fall River	John R. Mason	Laurel Lake Mills.
Fall River	Philip A. Mathewson	King Philip Mills.
Fall River	Thomas McAuliffe	Stevens Manufg. Co.
Fall River	William G. McLoon	Barnaby Manufg. Co.
Fall River	J. Edward Osborne	American Linen Co.
Fall River	Charles M. Shove	Granite Mills.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	J. C. Smith	Chace Mills.
Fall River	Albert A. Sweet	King Philip Mills.
Fall River	Richard Thackeray	Weetamoe Mills.
Fall River	George F. Tryon	Conanicut Mills.
Fiskdale	Oscar B. Truesdell	Fiskdale Mills.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	W. E. Keach	Grant Yarn Co.
Fitchburg	Arthur H. Lowe	Parkhill Manufg Co.
Fitchburg	David Lowe	Parkhill Manufg. Co.
Fitchburg	Warren M. Orswell	Orswell and Nockege Mills.
Fitchburg	Thomas C. Sheldon	Fitchburg Duck Mills.
Fitchburg	Walter F. Stiles	Orswell Mills.
Fitchburg	Ralph E. Thomspon	Parkhill Manufg. Co.
Great Barrington	Jno. H. C. Church	Monument Mills.
Griswoldville	James C. Deane	Griswoldville Manufg. Co.
Holyoke	Jones S. Davis	6 Newton Street.
Holyoke	Joseph M. Dunham	Merrick Thread Co.
Holyoke	Ernest Lovering	Lyman Mills.

Holyoke	C. W. Rider	Merrick Thread Co.
Hopedale	Eben S. Draper	Draper Co.
Hopedale	George A. Draper	Draper Co.
Hopedale	George Otis Draper	Draper Co.
Hopedale	William F. Draper	Draper Co.
Hopedale	William F. Draper, Jr.	Draper Co.
Housatonic	T. G. Ramsdell	Monument Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Co.
Indian Orchard	Henry C. Spence	Metallic Drawing Roll Co.
Indian Orchard	James Strang	Metallic Drawing Roll Co.
Lawrence	Lewis E. Barnes	Pemberton Co. and Methuen Co.
Lawrence	William A. Barrell	Lawrence Duck Co.
Lawrence	Eugene E. Burnham	Leather Belt Man'fr.
Lawrence	Frederick E. Clarke	
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Roscoe S. Milliken	Pemberton Co.
Lawrence	Walter E. Parker	Pacific Mills.
Lawrence	Robert Redford	Arlington Mills.
Lawrence	Charles M. Sears	Atlantic Cotton Mills.
Lawrence	William F. Sherman	P. O. Box 206.
Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	George W. Towne	Arlington Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	William S. Whitney	Washington Mills Co.
Leicester	Charles A. Denny	American Card Clothing Co.
Linwood	Arba C. Slater	Linwood Mills.
Lowell	George E. Ames	Lawrence Manufg. Co.
Lowell	Frank A. Bowen	Appleton Co.
Lowell	Christopher P. Brooks	Lowell Textile School.
Lowell	Edward N. Burke	Lowell Machine Shop.
Lowell	W. W. Carey	Machinery Manufacturer.
Lowell	Clarence N. Childs	Hamilton Manufg. Co.
Lowell	Alfred Clarke	Eastern Elec. Light & Stor. Bat. Co
Lowell	Alonzo A. Coburn	Atherton Machine Co.
Lowell	A. G. Cumnock	Boott Cotton Mills.
Lowell	Albert W. Danforth	881 Bridge St.
Lowell	Edward P. Dennis	Lowell Machine Shop.
Lowell	C. E. W. Dow	American Bolt Co.
Lowell	William A. Eastman	Lowell Hosiery Co.
Lowell	T. C. Entwistle	Manfr. Cotton Machinery.
Lowell	Frederick A. Flather	Lowell Machine Shop.
Lowell	Royal W. Gates	Josiah Gates & Sons.
Lowell	William E. Hall	Shaw Stocking Co.
Lowell	John H. Haworth	Haworth & Watson Manufg. Co.
Lowell	James G. Hill	
Lowell	George L. Hooper	7 Belmont Street.

Lowell	Alvin S. Lyon	Lowell Manufg. Co.
Lowell	Albert H. Morton	Kitson Machine Co.
Lowell	Oliver H. Moulton	Hamilton Manufg. Co.
Lowell	Franklin Nourse	Lawrence Manufg. Co.
Lowell	John W. Pead	Merrimac Manufg. Co.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	M. A. Rawlinson	Tremont & Suffolk Mills.
Lowell	William S. Southworth	Mass. Cotton Mills.
Lowell	Edward W. Thomas	Tremont and Suffolk Mills.
Lowell	Charles T. Upton	Shaw Stocking Co.
Lowell	Jude C. Wadleigh	Mass. Cotton Mills.
Lowell	Frederick T. Walsh	Lowell Bleachery & Dye Works.
Lowell	Walter S. Watson	Haworth & Watson Manufg. Co.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lynn	C. J. H. Woodbury	Secy. and Treas.
Manchaug	Eben C. Willey	Manchaug Co.
Methuen	G. B. Emmons	Emmons Loom Harness Co.
Millbury	Fred W. Moore	Cordis Mills.
Millbury	Henry M. Wilcox	John Rhodes Warp Co.
Millbury	Theop. W. Wilmarth	Millbury Cotton Mills.
New Bedford	George A. Ayer	City Manufg. Corp.
New Bedford	Robert Burgess	Pierce Manufg. Corp.
New Bedford	Byron F. Card	Howland Mills.
New Bedford	P. Y. DeNormandie	Potomska Mills.
New Bedford	Frederick Grinnell	Gen. Fire Ex. Co.
New Bedford	Henry A. Holcomb	Box 249.
New Bedford	Nathaniel B. Kerr	Grinnell Manufg. Corp.
New Bedford	Walter H. Langshaw	Dartmouth Manufg. Corp.
New Bedford	George H. Law	Bristol Manufg. Corp.
New Bedford	Stephen C. Lowe	Mill Supplies.
New Bedford	Andrew G. Pierce, Jr.	Wamsutta Mills, Pierce Manu. Corp. and Howland Mills Corp.
New Bedford	Herbert E. Walmesley	Wamsutta Mills.
New Bedford	William R. West	Roll Coverer.
Newton	Josiah G. Coburn	
Newton Upper Falls	Frank J. Hale	Saco and Pettee Machine Shops.
Newton Upper Falls	R. P. Snelling	Saco and Pettee Machine Shops.
North Adams	Charles W. Dennett	Johnson Manufg. Co. and Dunbar Mills Co.
Northbridge	Henry S. Houghton, Jr.	Paul Whitin Manufg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Manufg. Co.
North Cambridge	Colin C. Bell	Laminar Fibre Co.
North Oxford	Edwin N. Bartlett	Sigourney and Rockdale Mills.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.
North Uxbridge	Fred B. Whitin	Uxbridge Cotton Mills.
Oakdale	William B. Fittz	W. Boylston Manufg. Co.

Oakdale	Alfred N. Whiting	L. M. Harris Manufg. Co.
Pittsfield	L. C. Farnsworth	Farnsworth Card Clothing Co.
Reedville	George E. Spofford	Reedville Cotton Mills.
Salem	Alfred A. Hunting	Mechanical Engineer.
Salem	William P. McMullen	Naumkeag Steam Cotton Co.
Salem	N. G. Simonds	Naumkeag Steam Cotton Co.
Saundersville	Thomas Wilmarth	Saunders Cotton Mills.
Shattuckville	Frank S. Field	Massaemit Yarn Mills.
South Hadley Falls	William R. Hill	Glasgow Manufg. Co.
Taunton	A. C. Bent	Safety Seamless Pocket Co.
Taunton	John J. Connell	Cohannet Mills.
Taunton	Peter H. Corr	Cotton & Cotton Yarns and Waste.
Taunton	Thomas G. Cox	Mason Machine Works.
Taunton	P. T. Creed	Hopewell Mills.
Taunton	H. H. Culver	Elizabeth Poole Mill.
Taunton	Henry S. Culver	Westville Cotton Mill.
Taunton	Herbert Fisher	
Taunton	Abbott F. Lawrence	Nemasket Mills.
Taunton	Henry M. Lovering	Whittenton Manufg. Co.
Taunton	William M. Lovering	Whittenton Manufg. Co.
Taunton	Charles L. Macomber	Nemasket Mills.
Taunton	John Tempest Meats	Mason Machine Works.
Taunton	Herbert H. Shumway	Corr Manufg. Co.
Taunton	James W. Taylor	Canoe River Mills.
Thorndike	Charles H. Hobbs	Thorndike Co.
Three Rivers	Roscius C. Newell	Palmer Mills.
Turners Falls	Samuel L. Parker	Turners Falls Cotton Mills.
Waltham	Charles L. Bailey	Boston Manufg. Co.
Waltham	Charles E. Getchell	Waltham Bleachery and Dye Works.
Ware	George E. Tucker	The Otis Co.
Webster	A. W. Brainerd	H. N. Slater Mills.
Webster	Ernest E. Clark	H. N. Slater Mills.
West Boylston	F. H. Rice	Holbrook Mills.
West Fitchburg	John Leiper	Fitchburg Manufg. Co.
Westfield	Arthur W. Warren	W. Warren Thread Works.
West Warren	James W. Brown	Warren Cotton Mills.
Whitinsville	Alfred E. Adams	Linwood Mills.
Whitinsville	Josiah M. Lasell	The Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Cyrus A. Taft	Whitin Machine Works.
Whitinsville	Arthur F. Whitin	Saunders Cotton Mills.
Whitinsville	G. Marston Whitin	The Whitinsville Machine Works.
Williamstown Sta.	Roland R. Kelly	Williamstown Manufg. Co.
Winchendon Springs	Z. L. White	White Bros.
Worcester	George Crompton	Crompton & Knowles Loom Works.
Worcester	Randolph Crompton	Crompton & Knowles Loom Works.

Worcester	Henry F. Harris	West Boylston Manufg. Co.
Worcester	C. H. Hutchins	Crompton & Knowles Loom Works.
Worcester	John M. Russell	Crompton & Knowles Loom Works.
Worcester	Justin A. Ware	Crompton & Knowles Loom Works.
Worcester	A. S. Winslow	

RHODE ISLAND.

Albion	Andrew J. Currier	Albion & Valley Falls Co.
Allenton	R. A. Gray	Rodman Manufg. Co.
Ashton	Arthur H. Gulliver	Lonsdale Co.
Central Falls	Stephen L. Adams	Stafford Manufg. Co.
Central Falls	B. F. G. Linnell	P. O. Box 645.
Central Falls	O. B. Parker	U. S. Cotton Co.
Centreville	Harold Lawton	Warwick Mills.
Centreville	Robert B. Treat	Centreville Cotton Mills.
Crompton	C. T. Richmond	Crompton Co.
Crompton	Charles D. Robinson	Crompton Co.
Davisville	Walter B. Knight	Reynolds Manufg. Co.
Fiskville	James Gee	Interlaken Dye Works.
Georgiaville	Herbert R. Farnum	Bernon Mills.
Greenville	Reuben Pilling, Jr.	The Granite Mills Co.
Hamilton	Joseph Warren Greene	Hamilton Web Co.
Manville	Charles Henry Savage	Manville Co.
Manville	A. Tenny White	Manville Co.
Pawtucket	Abel T. Atherton	A. T. Atherton Machine Co.
Pawtucket	William W. Blades	Lorraine Manufg. Co.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	John J. Hart	Charlton Manufg. Co.
Pawtucket	David Jackson	Jackson Pat. Shell Roll Co.
Pawtucket	J. E. Jenckes	The E. Jenckes Manufg. Co.
Pawtucket	Ira J. Martin	Bozrahville Co.
Pawtucket	James R. MacColl	Lorraine Manufg. Co.
Pawtucket	F. C. Sayles	Ponemah Mills.
Pawtucket	Fred A. Wilde	A. T. Atherton Machine Co.
Peace Dale	William C. Greene	Peace Dale Manufg. Co.
Phenix	Henry R. Brown	Hope Co. and Phenix Mill.
Phenix	Jesse A. Knight	Harris Textile Co.
Pontiac	W. H. Summersby	Pontiac Mill and Bleachery.
Providence	Charles T. Aldrich	Aldrich Manufg. Co.
Providence	William Ames	Fletcher Manufg. Co.
Providence	H. C. Atwood	Williamsville Manufg. Co.
Providence	George R. Babbitt	American Oil Co.
Providence	Truman Beckwith	Dyerville Manufg. Co.
Providence	J. Frank Braids	Chas. S. Bush Co.

Providence	D. Russell Brown	Brown Bros. Co.
Providence	H. Martin Brown	Brown Bros. Co.
Providence	E. C. Bucklin	Harris Manufg. Co. and Interlaken Mills.
Providence	Charles H. Child	Brown Bros. Co.
Providence	Henry C. Clark	Standard Mill Supply Co.
Providence	Frank B. Comins	U. S. Aerophor Co.
Providence	Frederick I. Dana	Thomas Phillips Co.
Providence	A. Lockwood Danielson	Quinebaug Co.
Providence	J. DeForest Danielson	Lockwood Co. and Lewiston Bleachery and Dye Works.
Providence	John W. Danielson	Lockwood Co.
Providence	R. H. Deming	Cotton Broker.
Providence	J. Herbert Foster	Cotton Broker.
Providence	George A. Fuller	American Card Clothing Co.
Providence	William Gammell	Berkeley Co.
Providence	Rufus B. Goff	Standard Mill Supply Co.
Providence	William B. Gowdey	Mill Supplies.
Providence	William S. Granger	Granger Foundry & Machine Co.
Providence	Henry T. Grant, Jr.	Mercantile Mutual Fire Ins. Co.
Providence	David Grove	Dyerville Mfg. Co., 610 Manton Avenue.
Providence	John H. Hambley	Quidnick Manufg. Co.
Providence	A. Walter Harris	A. W. Harris Oil Co.
Providence	Elisha H. Howard	Harris Manufg. Co.
Providence	W. L. Hutchins	Crompron & Knowles Loom Works.
Providence	Joseph H. Kendrick	American Supply Co.
Providence	John M. Kimball	Slatersville Mills.
Providence	Stephen A. Knight	Hebron Manufg. Co.
Providence	Charles W. Lippitt	Silver Spring B. & D. Co.
Providence	Henry F. Lippitt	Social and Manville Cos.
Providence	Charles R. Makepeace	Mill Engineer.
Providence	F. H. Maynard	Gen. Fire Extinguisher Co.
Providence	Thomas Mayor	Thomas Mayor & Son.
Providence	William C. Peirce	Elizabeth Mills.
Providence	Stephen Minot Pitman	Narragansett Mutual Fire Ins. Co.
Providence	Charles A. M. Praray	Chas. A. M. Praray & Co.
Providence	Richard H. Rice	Providence Steam Engine Co.
Providence	Louis E. Robinson	Sea Island Cotton.
Providence	Frank P. Sheldon	Mill Engineer.
Providence	Harry M. Smith	Standard Mills Supply Co.
Providence	Wilton H. Spencer	Textile Manufacturer.
Providence	George W. Stafford	Crompton & Knowles Loom Works.
Providence	Daniel J. Sully	T. M. Reynolds & Co.
Providence	Edward P. Taft	Ponemah Mills.
Providence	Robert W. Taft	Coventry Co. and Bernon Mills.

Providence	Charles F. Taylor	Burgess Cop Tube Co.
Providence	D. M. Thompson	Corliss Steam Engine Co.
Providence	A. Curtis Tingley	Nat. Ring Traveler Co.
Quidnick	Albert Knight	Quidnick Mills.
Quidnick	Albert F. Knight	
Riverpoint	Arthur F. Brackett	Royal Valley and Arctic Mills.
Slatersville	Charles F. Farrar	The Wm. A. Slater Mills Corp.
Slatersville	William P. Holt	The Wm. A. Slater Mills Corp.
Valley Falls	Arnold B. Chace, Jr.	Woonsocket Mills.
Warren	Arnold Schaer	Warren Manufg. Co.
Warren	John Waterman	Warren Manufg. Co.
Westerly	J. H. Blades	Lorraine Manufg. Co.
Westerly	Louis L. Hohn	Wm. Clark Thread Co.
Westerly	W. Marshall Taylor	Wm. Clark Thread Co.
Woonsocket	Malcolm Campbell	Woonsocket Mach. & Press Co.
Woonsocket	Charles H. Gorton	Glenark Knitting Co.
Woonsocket	Frank Harris	Hamlet Mills.
Woonsocket	Henry S. Houghton, Sr.	Grids and Beaters.
Woonsocket	Albert C. Hoy	Hamlet Mills.
Woonsocket	Charles H. Merriman, Jr.	Globe Mill.
Woonsocket	William A. Robinson	Social Manufg. Co.
Woonsocket	Earl A. Thissell	Woonsocket Bobbin Co.
Woonsocket	Ariel C. Thomas	Clinton Manufg. Co.
Woonsocket	Charles E. Thomas	Forestdale Manufg. Co.

CONNECTICUT.

Baltic	Robert Rennie Taft	Baltic Power Co.
Danielson	James Herbert Smith	Quinebaug Co.
Hartford	William H. Stratton	Factory Ins. Asso.
Jewett City	J. Colby Lewis	The Wm. A. Slater Mills Corp.
Jewett City	A. T. Malcolmson	The Wm. A. Slater Mills Corp.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	A. A. Young, Jr.	Jewett City Mills.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	W. E. Atwood	Williamsville Manufg. Co.
Killingly	C. H. Truesdell	Attawaugan Co.
New Hartford	Robert R. Smith	Greenwoods Co.
New Haven	George S. Barnum	The Bigelow Co.
No. Grosvenor Dale	Frank M. Messenger	Grosvenor Dale Co.
Norwich	W. N. Blackstone	Attawaugan Co.
Norwich	W. R. Burnham	Uncasville Manufg. Co.
Norwich	C. H. Frisbie	Attawaugan Co.
Norwich	Marcellus Gould	Falls Co.
Norwich	W. G. Henderson	Shetucket Co.

Norwich	Moses Pierce	Aspinook Co.
Putnam	George W. Holt	Monohansett Manufg. Co.
Putnam	George A. Vaughan	Putnam Manufg. Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Uncasville	Charles D. White	Uncasville Manufg. Co.
Wauregan	James A. Atwood	Wauregan Mills.
Wauregan	John Walter Atwood	Wauregan Mills.
Willimantic	E. S. Boss	Willimantic Linen Co.
Willimantic	John Scott	Willimantic Linen Co.

NEW YORK.

Capron	W. H. Cloher, Jr.	Utica Cotton Co.
Cohoes	David S. Johnston	Cohoes Iron Foundry & Machine Co.
Cohoes	John E. Prest	Harmony Mills.
Hoosick Falls	O. W. Stites	
New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	Bliss, Fabyan & Co.
New York City	Edward R. Ballou	Brighton Mills.
New York City	John W. Ferguson	Builder and General Contractor.
New York City	Dudley T. Lyall	Brighton Mills.
New York City	William L. Lyall	J. & W. Lyall Loom & Mach. Works.
New York City	Arthur B. Mann	J. H. Martin & Co.
New York City	Arthur Parkinson	Arabol Manufg. Co.
New York City	Duncan D. Parmly	Johnson Mfg. Co.
New York City	Vladimir P. Polevoy	Yaroslovskair Cotton Mill.
New York Mills, Oneida Co.,	John P. Campbell,	New York Mills.
New York Mills, Oneida Co.,	Henry C. Phillips,	New York Mills.
Oswego	George H. Sayward	Standard Yarn Co.
Utica	George DeForest	Utica Steam Cotton Mills and Mohawk Valley Mills.
Utica	D. W. Gray	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills.
Victory Mills	Joseph O. Hannum	Saratoga Victory Manufg. Co.

NEW JERSEY.

Garwood	William B. Munroe	
Gloucester City	Philip H. Fowler	
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.
Jersey City	Maxwell Grierson	Jas. Chadwick & Bro., Ltd.
Millville	John K. Russell	May's Landing Water Power Co.
Newark	William H. Loftus	Clark Thread Co.

PENNSYLVANIA.

Chester	D. Edwin Irving	The Irving & Leiper Manufg. Co.
Chester	W. T. Galey	Aberfoyle Manufg. Co.
Lancaster	S. S. Spencer	Conestoga Steam Mills.
Mt. Joy	Thomas J. Brown	George Brown's Sons.
Philadelphia	Robert Beatty	Robert Beatty & Co.
Philadelphia	T. Ashby Blythe	Ashby Cotton Mills.
Philadelphia	Harry W. Butterworth	H. W. Butterworth & Sons.
Philadelphia	James Butterworth	H. W. Butterworth & Sons.
Philadelphia	Frederick A. Downes	Factory Mutual Fire Ins. Cos.
Philadelphia	Edward W. France	Phila. Textile School.
Philadelphia	Merrill A. Furbush	M. A. Furbush & Son Mach. Co.
Philadelphia	Joshua Garsed	Wingohocking Mills, Frankford.
Philadelphia	H. S. Grove	Argo Mills.
Philadelphia	W. C. Houston, Jr.	Hope Mills Manufg. Co.
Philadelphia	John H. Lorimer	Scouring, Dyeing and Drying Mach.
Philadelphia	David Milne	C. J. Milne & Sons.
Philadelphia	George Wood	Millville Manufg. Co.
Philadelphia	John P. Wood	William Wood & Co.
Trainer	William E. Trainer	Linwood Mills.

DELAWARE.

Wilmington	William P. Bancroft	Joseph Bancroft & Sons Co.
Wilmington	Daniel Moore Bates, Jr.	Joseph Bancroft & Sons Co.

MARYLAND.

Baltimore	James A. Gary	Gary Manufg. Co.

NORTH CAROLINA.

Asheville Spray	George A. Mebane	Asheville Cot. Mills. Spray Cotton Mills.
Charlotte	H. S. Chadwick	Dover Yarn Mill and Dilling Cotton Mills.
Charlotte	C. W. Johnston	The Highland Park Mfg. Co.
Charlotte	E. A. Smith	Charlotte Supply Co.
Charlotte	D. A. Tompkins	Atherton Mills.
Charlotte	Wm. Whittam, Jr.	
Charlotte	J. P. Wilson	Dover Yarn Mills.
Greensboro	Edward T. Garsed	Hucomuga Mills.
Henrietta	Fred S. Mosher	Henrietta Mills.

Kings Mountain	Philip S. Baker	Crowders Mt. Cotton Mills.
Kings Mountain	F. Dilling	Dilling Cotton Mills.
Kings Mountain	C. E. Falls	Enterprise Mills.
Lincolnton	R. S. Reinhardt	Elm Grove Cotton Mills.
Mountain Island	W. T. Jordan	Mt. Island Manufg. Co.
Reidsville	John W. Arrington	Edna Cotton Mills.
Reidsville	James R. Pearce	Edna Cotton Mills.

SOUTH CAROLINA.

Columbia	Charles K. Oliver	Columbia Mills Co.
Columbia	W. B. Smith-Whaley	Richland Cotton Mills.
Gaffney	H. D. Wheat	Gaffney Manufg. Co.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Manufg. Co. and Aiken Manufg. Co.
Newberry	Edward B. Wilbur	Newberry Cotton Mills.
Orangeburg	Arthur Whittam	The Enterprise Cotton Mills.
Pelzer	B. F. Guy	Pelzer Manufg. Co.
Pelzer	Ellison A. Smyth	Pelzer Manufg. Co.

GEORGIA.

Atlanta	J. F. Dickinson	So. Belting Co.
Atlanta	Oscar Elsas	Fulton Bag and Cotton Mills.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.
Augusta	Otis G. Lynch	Enterprise Manufg. Co.
Augusta	Joel Smith	J. P. King Mfg. Co.
Augusta	George R. Stearns	Riverside Mills.
Columbus	E. N. Clemence	Eagle & Phenix Manufg. Co.
Griffin, Spalding Co.	Albert G. Martin	Kincaid Manufg. Co.
La Grange,	Samuel Hale	Dixie Cotton Mills.
Lindale, Floyd Co.	Arthur W. Hunking	Mass. Mills in Georgia.
Macon	W. H. Richmond	Bibb Mill No. 2.

TENNESSEE.

Knoxville	William T. Lang	Brookside Mills.
Nashville	T. B. Dallas	Phenix Cotton Mills, Dallas Mfg. Co.

MISSOURI.

St. Louis	D. C. Ball	American Cotton Co.
St. Louis	Jerome Hill	2233 Park Avenue.

LOUISIANA.

New Orleans	S. Odenheimer	Lane Mills.

KENTUCKY.

Henderson	Paul J. Marrs	Henderson Cotton Mills.

ALABAMA.

Cordova	Albert W. Dimick	Indian Head Mills.
Huntsville	T. W. Pratt	West Huntsville Cotton Mills.

TEXAS.

Dickinson	Lawrence V. Elder	
Galveston	D. M. Ehrlich	Galveston Cotton Mills.
Waco	Jno. Hopkinson	Slayden & Kirksey Woolen Mills.

CANADA.

Hamilton, Ont.	Charles Owen Dexter	Canadian Colored Cotton Mills Ltd.
Hamilton, Ont.	Harry W. Kimball	
Hamilton, Ont.	Farquharson J. Muir	Canadian Colored Cotton Mills Ltd.
Hochelaga, P. Q.	W. S. Hume	Dominion Cotton Mills, Ltd.
Montreal, P. Q.	Alfred Hawkesworth	Merchants Cotton Co.
Montreal, P. Q.	Fred Hawkesworth	Merchants Cotton Co.
Valleyfield, P. Q.	Fred Lacey	Montreal Cotton Co.
Valleyfield, P. Q.	Louis Simpson	Montreal Cotton Co.
Windsor, N. S.	Henry D. Martin	Dominion Cotton Mills, Ltd.

NEW BRUNSWICK.

Marysville	John B. Cudlip	Gibson Cotton Mills.
St. John	John H. Parks	Wm. Parks & Sons, Ltd.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	18
New Hampshire	26
Vermont	1
Massachusetts	252
Rhode Island	104
Connecticut	28
New York	21
New Jersey	6
Pennsylvania	19
Delaware	2
Maryland	1
North Carolina	16
South Carolina	9
Georgia	11
Kentucky	1
Tennessee	2
Missouri	2
Louisiana	1
Texas	3
Alabama	2
Canada	8
New Brunswick	2
	535

IN MEMORIAM.

WARREN M. ORSWELL.

WARREN M. ORSWELL, president of the Orswell Mills and of the Nockege Mills of Fitchburg, Mass., and treasurer of the Lancaster Mills of Lancaster, Mass., died on Monday, July 5th, 1897, at the home of his daughter, Mrs. ELVIRA GAYLORD, in Pawtucket, R. I.

He had been ill for a year and had not taken an active part in business for eight or nine months previous to his death. He was elected to membership in the Association, April 16, 1873.

Mr. ORSWELL was born at Providence, R. I. His first experience in a cotton mill was at Blackstone, and when only eighteen years of age, he became an overseer in the mills at Valley Falls, R. I. From there he went to the Wamsutta mills at New Bedford as overseer, and later he was for seven years superintendent of the Albion company's mills at Albion, R. I.

From Albion he went to Shirley, Mass., where he became superintendent of the Phœnix and Fredonia Mills, and later started the Shirley Yarn Company.

In May, 1886, he came to Fitchburg as president of the Orswell Mills, and in 1888, the Lancaster Manufacturing Company was started, he was treasurer since the organization. The Nockege Mill was started in February, 1893, Mr. ORSWELL being president of the organization to his death.

Mr. ORSWELL was a practical manufacturer of first-class

ability, and a gentleman of high character. The corporations of which he was active in the management, have greatly promoted the growth and prosperity of the city. He was of a retiring nature but had a circle of warm intimate friends.

THOMAS B. WATTLES.

Mr. THOMAS B. WATTLES, one of the charter members of the Association, died very suddenly at Penacook, N. H., on March 6, 1898.

He was born at Norwich, Conn., Nov. 15, 1835, and began his life work in a cotton mill at the age of eight years. When twenty years old, he was appointed agent of the Pembroke Mills at Pembroke, N. H., and four years later became agent of the Hookset Mills, Hookset, N. H. Subsequently he went to Canton, Mass., where he remained as agent of the Neponset Mills until 1892, when he became agent of the Chicopee Manufacturing Company at Chicopee Falls, Mass.

On leaving Chicopee, he was in commercial business for a while and afterwards became manager and selling agent of the Boscowan Mills at Penacook, which position he held at the time of his death.

Mr. WATTLES was a member of the Congregational church and was also a member of the Masonic order, and one whose genial presence and sterling character rendered him highly esteemed among his associates.

JEREMIAH CLARK.

Lowell has been called upon to mourn the loss by death of Mr. JEREMIAH CLARK, who passed away April 22, 1898, after being confined to the house for about three weeks.

Mr. CLARK was a little over seventy-nine years of age, and came to Lowell in 1835, when a young man entering the Lowell Machine Shop, in whose service he remained nearly thirty-five years, occupying at the last a prominent position with that company. In 1867 he established himself as a dealer in textile machinery, and his business became one of the largest in the country, and it is safe to say he has had business transactions with nearly every member of this Association.

Mr. CLARK was closely identified with not only the city government of Lowell, but had the honor of serving in the House and Senate of the Commonwealth of Massachusetts. He was ever a staunch republican, and had labored for the success of that party for many years. He was also closely identified with the church to which he belonged, and in its service had held the position of treasurer for thirty-eight years. He was also a member of the Young Men's Christian Association, was a trustee in the Old Ladies' Home, as well as being one of the original founders of the same.

At the time of his death he was president of the Mechanics Savings Bank, a member of the various Masonic societies, Middlesex Club and of this Association; and it was a pleasure to him, as well as many of its members, to meet while the meetings were in session, and rarely did he fail to attend its stated meetings.

Mr. CLARK was a most charitable man, and many were the regrets of people whom he had assisted when it was learned he was dead. Particularly sad was the fact that Mr. CLARK survived his wife by less than forty-eight hours, to whom he had been married fifty-eight years.

The funeral of Mr. and Mrs. CLARK took place on Monday, April 25, 1898, from his late residence, and the house was not large enough to hold all the sympathizing friends attending the last tribute of respect to his memory.

PROCEEDINGS.

In accordance with the legal notice, the stated annual meeting of the Association was held in Chipman Hall, Boston, on April 27 and 28, 1898.

The following one-hundred and ninety-three members were present:

HONORARY MEMBERS.

JONES S. DAVIS, Holyoke, Mass.
SAMUEL WEBBER, Charlestown, N. H.

ACTIVE MEMBERS.

STEPHEN L. ADAMS, Central Falls, R. I.
JOSEPH D. AIKEN, Taftville, Conn.
ABEL T. ATHERTON, Pawtucket, R. I.
EDWARD ATKINSON, Boston, Mass.
H. C. ATWOOD, Providence, R. I.
CHARLES L. BAILEY, Waltham, Mass.
JOSEPH P. BATTLES, Boston, Mass.
ROBERT BEATTY, Philadelphia, Pa.
T. ASHBY BLYTHE, Philadelphia, Pa.
RICHARD B. BORDEN, Fall River, Mass.
STEPHEN N. BOURNE, Manchester, N. H.
ARTHUR F. BRACKETT, Riverpoint, R. I.
CHRISTOPHER P. BROOKS, Lowell, Mass.
HENRY R. BROWN, Phenix, R. I.

James W. Brown, West Warren, Mass.
Edward N. Burke, Lowell, Mass.
W. R. Burnham, Norwich, Conn.
John P. Campbell, New York Mills, Oneida Co., N. Y.
George A. Chace, Fall River, Mass.
Elmer G. Childs, Bondsville, Mass.
Jno. H. C. Church, Great Barrington, Mass.
Alfred Clarke, Lowell, Mass.
Ernest E. Clark, Wilkinsonville, Mass.
Frank B. Comins, Providence, R. I.
John J. Connell, Taunton, Mass.
Henry S. Culver, Taunton, Mass.
Andrew J. Currier, Valley Falls, R. I.
Woodbury K. Dana, Westbrook, Me.
A. Lockwood Danielson, Providence, R. I.
John W. Danielson, Providence, R. I.
Edward P. Dennis, Lowell, Mass.
Eben S. Draper, Hopedale, Mass.
George Otis Draper, Hopedale, Mass.
Russell W. Eaton, Brunswick, Me.
John Eccles, Taftville, Conn.
William Evans, Fall River, Mass.
Charles F. Farrar, Jewett City, Conn.
William Firth, Boston, Mass.
Herbert Fisher, Taunton, Mass.
William B. Fittz, Oakdale, Mass.
Frederick A. Flather, Lowell, Mass.
M. F. Foster, Milford, N. H.
C. H. Frisbie, Norwich, Conn.
Joshua Garsed, Philadelphia, Pa.
James Gee, Fiskville, R. I.
Daniel Gilligan, Fall River, Mass.
Alfred M. Goodale, Boston, Mass.
Charles H. Gorton, Woonsocket, R. I.
Marcellus Gould, Norwich, Conn.
George P. Grant, Jr., Fitchburg, Mass.
R. A. Gray, Allenton, R. I.
Stephen Greene, Boston, Mass.
David Grove, Providence, R. I.
Arthur H. Gulliver, Ashton, R. I.

FRANK J. HALE, Newton Upper Falls, Mass.
Z. D. HALL, Adams, Mass.
A. M. HAMILTON, Fall River, Mass.
WILLIAM B. HAWES, Fall River, Mass.
ALFRED HAWKESWORTH, Montreal, P. Q.
FRED HAWKESWORTH, Montreal, P. Q.
WILLIAM HAYES, Auburn, Me.
W. G. HENDERSON, Norwich, Conn.
JAMES G. HILL, Lowell, Mass.
CHARLES H. HOBBS, Thorndike, Mass.
GEORGE W. HOLT, Putnam, Conn.
WILLIAM P. HOLT, Slatersville, R. I.
GEORGE L. HOOPER, Lowell, Mass.
THOMAS HORSFIELD, Fall River, Mass.
HENRY S. HOUGHTON, JR., Northbridge, Mass.
W. S. HUME, Montreal, P. Q.
W. E. KEACH, Fitchburg, Mass.
ROLAND R. KELLY, Williamstown Station, Mass.
JOSEPH H. KENDRICK, Provincetown, R. I.
JOHN KILBURN, Belmont, Mass.
HARRY W. KIMBALL, Slatersville, R. I.
JOHN M. KIMBALL, Providence, R. I.
BENJAMIN B. KIRK, Fall River, Mass.
JESSE A. KNIGHT, Phenix, R. I.
STEPHEN A. KNIGHT, Providence, R. I.
HAROLD LAWTON, Centreville, R. I.
EVAN ARTHUR LEIGH, Boston, Mass.
JOHN LEIPER, W. Fitchburg, Mass.
J. COLBY LEWIS, Jewett City, Conn.
B. F. G. LINNELL, Pawtucket, R. I.
WILLIAM L. LYALL, New York City.
JAMES R. MACCOLL, Pawtucket, R. I.
CHARLES R. MAKEPEACE, Providence, R. I.
CHARLES H. MANNING, Manchester, N. H.
JOHN R. MASON, Fall River, Mass.
THOMAS MAYOR, Providence, R. I.
ROBERT MCARTHUR, Biddeford, Me.
FRED C. MCDUFFIE, Boston, Mass.
WILLIAM G. MCLOON, Fall River, Mass.
WILLIAM P. MCMULLAN, Salem, Mass.

John Tempest Meats, Taunton, Mass.
Frank M. Messenger, No. Grosvenor Dale, Conn.
W. H. Miles, Lisbon, Me.
James I. Milliken, Lawrence, Mass.
Roscoe S. Milliken, Lawrence, Mass.
Edward A. Mongeon, Blackstone, Mass.
Fred W. Moore, Millbury, Mass.
William B. Munroe, Garwood, N. J.
Roscius C. Newell, Three Rivers, Mass.
Elmer E. Page, Saco, Me.
O. B. Parker, Central Falls, R. I.
Walter E. Parker, Lawrence, Mass.
William C. Peirce, Providence, R. I.
Haven C. Perham, Lowell, Mass.
Herbert L. Pratt, Lewiston, Me.
John E. Prest, Cohoes, N. Y.
M. W. Quinn, Amesbury, Mass.
T. G. Ramsdell, Housatonic, Mass.
F. H. Rice, West Boylston, Mass.
Charles H. Richardson, Clinton, Mass.
C. T. Richmond, Crompton, R. I.
Charles D. Robinson, Crompton, R. I.
John K. Russell, Millville, N. J.
Arnold Schaer, Warren, R. I.
Thomas C. Sheldon, Fitchburg, Mass.
Herbert H. Shumway, Taunton, Mass.
John Smith, Fall River, Mass.
Robert R. Smith, New Hartford, Conn.
William O. Smith, Easthampton, Mass.
Wilton H. Spencer, Providence, R. I.
George E. Spofford, Readville, Mass.
Walter F. Stiles, Fitchburg, Mass.
O. W. Stites, Hoosick Falls, N. Y.
Walter H. Summersby, Pontiac, R. I.
James O. Sweet, Jewett City, Conn.
Edward P. Taft, Providence, R. I.
James W. Taylor, Taunton, Mass.
W. Marshall Taylor, Westerly, R. I.
Earl A. Thissell, Lowell, Mass.
Edward W. Thomas, Lowell, Mass.

D. M. Thompson, Providence, R. I.
Robert B. Treat, Centerville, R. I.
C. H. Truesdell, Killingly, Conn.
Oscar B. Truesdell, Fall River, Mass.
George F. Tryon, Fall River, Mass.
William D. Twiss, Lawrence, Mass.
George A. Vaughan, Putnam, Conn.
Joseph W. Wattles, Canton Junction, Mass.
Channing Whitaker, Lowell, Mass.
Alfred N. Whiting, Oakdale, Mass.
George F. Whitten, Manchester, N. H.
Henry M. Wilcox, Millbury, Mass.
Theop. W. Wilmarth, Millbury, Mass.
Thomas Wilmarth, Saundersville, Mass.
John P. Wood, Philadelphia, Pa.
C. J. H. Woodbury, Lynn, Mass.
Adelbert R. Young, Jewett City, Conn.

ASSOCIATE MEMBERS.

Henry Ashworth, Fall River, Mass.
Colin C. Bell, North Cambridge, Mass.
William H. Bent, Taunton, Mass.
J. Frank Braids, Providence, R. I.
Henry G. Brinckerhoff, Boston, Mass.
H. Martin Brown, Providence, R. I.
John H. Burghardt, Boston, Mass.
Eugene E. Burnham, Lawrence, Mass.
James Butterworth, Philadelphia, Pa.
Malcolm Campbell, Woonsocket, R. I.
W. W. Carey, Lowell, Mass.
Charles H. Child, Providence, R. I.
Henry C. Clark, Providence, R. I.
Thomas G. Cox, Taunton, Mass.
G. B. Emmons, Methuen, Mass.
T. C. Entwistle, Lowell, Mass.
George A. Fuller, Providence, R. I.
John T. Fyans, Fall River, Mass.
H. P. Garland, Biddeford, Me.
Royal W. Gates, Lowell, Mass.

Rufus B. Goff, Providence, R. I.
William S. Granger, Providence, R. I.
Alfred H. Hartley, Fall River, Mass.
Henry S. Houghton, Sr., Woonsocket, R. I.
David Jackson, Pawtucket, R. I.
Stephen C. Lowe, New Bedford, Mass.
H. G. McKerrow, Boston, Mass.
William R. Noone, Boston, Mass.
Sidney B. Paine, Boston, Mass.
Arthur Parkinson, New York, N. Y.
Charles A. M. Praray, Providence, R. I.
John M. Russell, Worcester, Mass.
Harry M. Smith, Providence, R. I.
R. Paul Snelling, Newton Upper Falls, Mass.
Henry C. Spence, Indian Orchard, Mass.
Cyrus A. Taft, Whitinsville, Mass.
Winthrop Thayer, Boston, Mass.
A. Curtis Tingley, Providence, R. I.
William V. Threlfall, Newton Upper Falls, Mass.
Justin A. Ware, Worcester, Mass.
Walter S. Watson, Lowell, Mass.
Fred A. Wilde, Pawtucket, R. I.

FIRST SESSION.

CHIPMAN HALL, TREMONT TEMPLE,
BOSTON, MASS., Wednesday, April 27, 1898.

The meeting was called to order at 11 A. M., President RUSSELL W. EATON in the chair.

The Secretary read the following call to the meeting.

BOSTON, MASS., April 1, 1898.

To the members:

Notice is hereby given that the stated annual meeting of this Association will be held at Boston, Mass, Wednesday and Thursday, April 27 and 28, 1898. The sessions will be held in Chipman Hall, in the Tremont Temple Building, No. 88 Tremont Street, a short distance south of School Street, and opposite the Tremont Building.

The sessions will be called to order on Wednesday at 11 A. M. and 2 P. M., and on Thursday at 10 A. M. and 2 P. M.

By order of the Board of Government,

C. J. H. WOODBURY,
Secretary.

The SECRETARY. In accordance with Article 14 of the by-laws, I certify that this call was mailed to each member at least ten days before this meeting, and that a quorum is now present.

The notice to members in full and the programme are as follows:

CALL TO ANNUAL MEETING

No. 64.

AT BOSTON, MASS.

BOSTON, MASS., April 1, 1898.

To the Members:

Notice is hereby given that the stated Annual Meeting of this Association will be held at Boston, Mass., Wednesday and Thursday, April 27 and 28, 1898. The sessions will be held in Chipman Hall, in the Tremont Temple Building, No. 88 Tremont Street, a short distance south of School Street, and opposite the Tremont Building. The entrance is at No. 88 Tremont Street, and Chipman Hall is on the sixth floor, reached by elevators.

The sessions will be called to order on Wednesday at 11 A. M. and 2 P. M., and on Thursday at 10 A. M. and 2 P. M.

The Board of Government have not provided any entertainment, but the sessions will be held only during the day, leaving the evening free to those who desire to avail themselves of the numerous attractions of the city.

It is requested that propositions for membership be sent in as soon as possible, to enable the Board of Government to take the necessary preliminary action.

Candidates for membership are cordially invited to be present at the meeting and to take part in the proceedings.

The souvenir badges will be given to those members who are in attendance, and the Board of Government has given instructions that duplicates shall not be given until after the adjournment.

The Trustees of the Lowell Textile School invite the members to visit the institution after the meeting. Train leaves Boston for Lowell from the Union Station at 9.25 Friday morning.

It is the desire of the Board of Government that this meeting shall be one especially devoted to the discussion of the papers and the topical questions. With that object in view, it is hoped that members will carefully examine the list of papers and topical questions, for the purpose of being prepared to add their contribution to the discussion.

PAPERS.

The full programme will be distributed at the meeting and it will include papers upon the following subjects: "The New Roller Gin", "Improved Methods of Baling Cotton", "The Round Bale", "Flax Manufacture by Cotton Mills", "Southern Cotton Mills and Manufacture as Seen by a Northern Man", "Improvements in Pickers" "The Ring Traveler", "Steaming Filling", "Slashing", "Take-up Motions on Looms", "The Shuttle Shifting Loom", "Cotton Mill Costings", "Early Inventions upon Copper Printing Rolls", "Our Export Trade in Cotton Goods", "Cotton Manufacturing in Mexico" and "What I Don't Know about a Cotton Mill".

TOPICAL QUESTIONS.

91. Can a systematic method of costs be determined for weaving?

92. Where is the economical range that ring filling frames may be used in competition with mules; that is, the lowest and highest number of yarn?

93. In large manufacturing plants, having a number of rooms on each principal operation, which is the better, to have one overseer or department man in charge of each special operation, or to have a larger number of men in charge of smaller sections?

94. What is the best method of treating belts, and their proper care?

95. What is the best method of utilizing the waste products of a mill?

96. In which class of machinery, as at present running, is it desirable to improve the most to obtain a minimum cost in manufacturing?

97. What is the best method of cleaning mill windows?

98. What advantages does an electric motor possess over a transmission dynamometer for measuring the power required to drive textile machinery?

99. What is the best taper or length of wind for mule cops on No. 37 filling?

Members are respectfully requested to sign and mail postal card receipts mailed with the Transactions and also for the certificates of membership, because this is necessary in order to keep the work of the

office to a proper standpoint of efficiency, and to keep a record of the numerous changes in the addresses, so that the members may receive their books from the Association.

By order of the Board of Government,

C. J. H. WOODBURY,
Secretary.

PROGRAMME.

First Session, Wednesday, April 27, 1898, at 11 A. M.

Call to Order.

President's Address. RUSSELL W. EATON, Brunswick, Me.

Election of Members.

Report of Secretary and Treasurer.

Election of Officers.

Flax Culture and the Manufacture of Linens to take the Place of Coarser Cottons in New England.
JONES S. DAVIS, Holyoke, Mass.

Second Session, Wednesday, April 27, 1898, at 2 P. M.

The Prior Roller Cotton Gin.
THOMAS W. PRIOR, Philadelphia, Pa.

The Round Bale at the Mill.
STEPHEN N. BOURNE, Manchester, N. H.

One Hundred Years of Ginning and Baling Cotton.
GEORGE A. LOWRY, Philadelphia, Pa.

The Excelsior Spinning Frame.
ABEL T. ATHERTON, Pawtucket, R. I.

TOPICAL QUESTIONS.

91. Can a systematic method of costs be determined for weaving?

92. Where is the economical range that ring filling frames may be used in competition with mules; that is, the lowest and highest number of yarn?

93. In large manufacturing plants, having a number of rooms on each principal operation, which is the better, to have one overseer or department man in charge of each special operation, or to have a larger number of men in charge of smaller sections?

Third Session, Thursday, April 28, 1898, at 10 A. M.

Steaming Filling.
EDWARD A. MONGEON, Blackstone, Mass.

The Shuttle Shifting Loom.
RANDOLPH CROMPTON, Worcester, Mass.

Slashing.
GEORGE F. TRYON, Fall River, Mass.

The Bastard Reed for Cotton Weaving.
ARTHUR PARKINSON, 13 Gold St., New York, N. Y.

Fourth Session, Thursday, April 28, 1898, at 2 P. M.

Our Export Trade in Cotton Goods.
CHRISTOPHER P. BROOKS, Director Lowell Textile School, Lowell, Mass.

The Nicaragua Ship Canal.
GARDINER C. SIMS, Providence, R. I.

Cotton Mill Costs.
WILLIAM WHITTAM, JR., Charlotte, N. C.

Early Inventions upon Copper Printing Rolls.
COL. SAMUEL WEBBER, Charlestown, N. H.

What I Don't Know About a Cotton Mill.
MALCOLM CAMPBELL, Woonsocket, R. I.

TOPICAL QUESTIONS.

94. What is the best method of treating belts, and their proper care?

95. What is the best method of utilizing the waste products of a mill?

96. In which class of machinery, as at present running, is it desirable to improve the most to obtain a minimum cost in manufacturing?

97. What is the best method of cleaning mill windows?

98. What advantages does an electric motor possess over a transmission dynamometer for measuring the power required to drive textile machinery?

99. What is the best taper or length of wind for mule cops on No. 37 filling?

The attention of the members is called to the following invitation to visit the Museum of Fine Arts, at Copley Square, where there is a fine exhibition of textiles in addition to other works of art:

The Trustees of the Museum of Fine Arts have the honor to invite the members of the New England Cotton Manufacturers' Association, who may attend the Sixty-fourth Meeting of the Association, to visit the Museum on the 27th and 28th of April.

The wearing of the badge of the Association, or the statement that they are members of it, will give admission.

Respectfully,

CHARLES G. LORING,

Director.

The Trustees of the Lowell Textile School invite the members to visit the institution after the meeting. A convenient train leaves Boston for Lowell from the Union Station at 9.25 Friday morning.

PRESIDENT'S ADDRESS.

RUSSELL W. EATON, Brunswick, Maine.

Gentlemen:—We cannot well begin this meeting without referring for a moment at least to our last one, the one held in Philadelphia. Without question it was the most brilliant and altogether satisfactory meeting that this Association has ever held. The subjects discussed were interesting, the place was attractive, and above all we were there received by ladies and gentlemen who strove to make our stay in their beautiful city a continual pleasure.

Not only our own members resident there but a large number of others welcomed us and made our Philadelphia meeting an event never to be forgetten.

Today we meet again in our "home". We shall be busy with the consideration of the papers on our programme.

These contributions are from members old and new and from widely separated sections of the country. It is pleasant to note that the growth of the Association in receipts and in membership is accompanied by a broadening of the list geographically. We now represent not only New England but nearly all the prominent centres of the Middle and Southern States.

Gentlemen, you will find that our programme at this meeting contains contributions from members directed to the statement of old methods, the analysis of present and the investigations of new ones.

Let us enter into the discussion of them in a way that will make them most useful to us.

The SECRETARY. The Board of Government present with their approval the following names of candidates for membership.

FOR ACTIVE MEMBERSHIP.

B. A. ALEXANDER, Supt. Boston Duck Co., Bondsville, Mass.
By Mr. ELMER G. CHILDS.

DANIEL MOORE BATES, JR., Asst. Supt. Joseph Bancroft & Sons Co., Wilmington, Del.
By Mr. WALTER E. PARKER.

J. H. BLADES, Supt. Lorraine Manufg. Co., Westerly, R. I.
By Mr. W. MARSHALL TAYLOR.

A. W. BRAINERD, Agt. H. N. Slater Mills, Webster, Mass.
By Mr. JOHN ECCLES.

EDWARD T. GARSED, Treas. Hucomuga Mills, Greensboro, N. C.
By Mr. RUSSELL W. EATON.

JAMES GEE, Mgr. Interlaken Dye Works, Fiskville, R. I.
By Mr. ARTHUR F. BRACKETT.

MAXWELL GRIERSON, Gen. Mgr. Jas. Chadwick & Bro., Ltd., Jersey City, N. J. By Mr. WILLIAM FIRTH.

DAVID GROVE, Supt. Dyerville Mfg. Co., 610 Manton Ave., Providence, R. I. By Mr. H. MARTIN BROWN.

H. S. GROVE, Pres. and Gen. Mgr. Argo Mills, Philadelphia, Pa.
By Mr. H. T. WHITIN.

ALBERT C. HOY, Asst. Supt. Hamlet Mills, Woonsocket, R. I.
By Mr. CHARLES H. MERRIMAN, JR.

C. W. JOHNSTON, Treas. The Highland Park Mfg. Co., Charlotte, N. C.
By Mr. WILLIAM WHITTAM, JR.

GEORGE A. MEBANE, Sec. and Treas. Asheville Cotton Mills, Asheville, N. C., and Pres. Spray Cotton Mills, Spray, N. C.
By Mr. FRED C. MCDUFFIE.

R. S. REINHARDT, Treas. Elm Grove Cotton Mills, Lincolnton, N. C.
By Mr. FRED C. MCDUFEIE.

CHARLES M. SEARS, Agt. Atlantic Cotton Mills, Lawrence, Mass.
By Mr. GEORGE W. STAFFORD.

N. G. SIMONDS, Treas. Naumkeag Steam Cotton Co., Salem, Mass.
By Mr. WILLIAM P. MCMULLAN.

JAMES HERBERT SMITH, Supt. Quinebaug Co., Danielson, Conn.
By Mr. JAMES A. ATWOOD.

WILTON H. SPENCER, Textile Manufacturer, 7 Exchange Place, Providence, R. I.
By Mr. J. K. RUSSELL.

ARTHUR WHITTAM, Supt. The Enterprise Cotton Mills, Orangeburg, S. C.
By Mr. WILLIAM WHITTAM, JR.

JOHN H. WHITTEN, Supt. Stark Mills, Manchester, N. H.
By Mr. STEPHEN N. BOURNE.

FOR ASSOCIATE MEMBERSHIP.

HENRY C. CLARK, Standard Mill Supply Co., Providence, R. I.
By Mr. JOHN E. PREST.

W. L. HUTCHINS, Asst. Mgr. Crompton & Knowles Loom Works, Providence, R. I.
By Mr. GEORGE W. STRAFFORD.

GEORGE A. LOWRY, Consulting Engineer, Planters' Compress Co., Boston, Mass.
By Mr. FRED C. MCDUFFIE.

THOMAS MCAULIFFE, Supt. Stevens Mfg. Co., Fall River, Mass.
By Mr. JOHN F. HAMLET.

CHARLES F. TAYLOR, Owner and Mgr. Burgess Cop Tube Co., Providence, R. I.
By Mr. H. T. WHITIN.

The President appointed Messrs. ARTHUR H. GULLIVER and GEORGE P. GRANT, JR., a committee to distribute, collect and count ballots, who reported later that they had attended to their duty and that each of the names had received seventy-one votes, whereupon the President declared that all the persons whose names are on the ballot were elected.

TREASURER'S REPORT.

C. J. H. WOODBURY, TREASURER, IN ACCOUNT WITH THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

April 1, 1897, to April 1, 1898.

DEBTORS.

Cash on hand April 1, 1897,	$105 46	
Active membership dues,	1,987 00	
Associate membership dues,	920 00	
Active admission fees,	550 00	
Associate admission fees,	550 00	
Rent of desk room,	105 96	
Sale of Transactions and miscellaneous,	54 25	
Association fund,	1,000 00	
Advertising,	490 00	
Interest,	59 87	
Total,		$5,822 54

CREDITORS.

Rent of office,	$504 17	
Secretary and Treasurer,	666 65	
Reports of meetings,	130 16	
Notices and stationery,	131 35	
Meeting expenses,	195 94	
Board of Government,	180 16	
Printing and distributing Transactions,	1,588 50	
Advance copies of papers,	80 50	
Engraving,	86 62	
Badges,	25 00	
Stenographer and proof reading,	581 18	
Post office box,	10 00	
Amount forward,		$4,180 23

Amount forward,	$4,180 23	
Postage, telegrams, and express,	165 95	
Office supplies,	15 61	
Certificates of membership,	9 06	
Miscellaneous,	3 00	
Securities and cash,	1,448 69	
Total,		$5,822 54

AUDITOR'S REPORT.

I hereby certify that the accounts from April 1, 1897, to April 1, 1898, are correctly cast, that all payments are properly vouched by bills approved by the Auditing Committee of the Board of Government, that the funds are kept on deposit in the name of the New England Cotton Manufacturers' Association, and that the amount of the deposit April 1, 1898, agrees with the balance on the books viz., $448.69.

The security in which the Association funds have been invested has been examined.

J. HERBERT SAWYER,
Auditor.

BOSTON, April 9, 1898.

The earnings of the Association for the year have been as follows:

Cash receipts,	$4,717 08		
Assessments unpaid,	330 00		
Due for Transactions,	16 00		
Due for advertisements,	280 00		
		$5,343 08	
Assessments of previous years,		70 00	
Total,			$5,273 08
Expenses,			4,333 85
Gain.			$939 23

The following table shows the facts of record relative to the affairs of the Association for the last eight years:

MEMBERSHIP.			TRANSACTIONS.			FINANCES.				
Fiscal Year Ending April 1.	Enrollment.	Members Elected.	Volume · Number.	Pages in Volume.	Pages for Year.	Receipts.	Expenses.	Cost per Page of Transactions.	Cost per Member.	Cost per Page of Transactions for each member Cents.
1891	246	18	48 49	43 62	105	$1,142 00	$926 08	$8 82	$3 76	3.59
1892	254	12	50 51	129 60	189	1,260 68	1,374 46	7 27	5 41	2.86
1893	244	31	52 53	63 94	157	1,678 33	1,603 25	12 12	6 57	6.33
1894	259	19	54 55	84 86	170	1,414 58	1,807 60	10 63	7 03	4.14
1895	270 292	35	56 57	73 230	303	1,947 07	1,957 64	6 46	6 71	2.21
1896	383 422	142	58 59	310 327	637	4,579 19	3,636 31	5 71	8 59	1.34
1897	450 459	49	60 61	269 359	628	3,710 02	3,980 34	6 33	8 67	1.43
1898	495 523	83	62 63	353 433	786	4,717 08	4,333 85	5 51	8 28	1.18

The Board of Government has held seven meetings during the year, at which the interests of the Association received careful attention, the most important action, outside of routine, being the issuance of certificates of membership, following in this respect the precedent of other technical societies and organizations of similar importance. This and the publication of the unusually large amount of Transactions has been possible only through the added income furnished by admitting advertisements from members at the end of the Transactions. This action was not taken until the subject was very thoroughly considered, and a consensus of the opinions of numerous members of the Association obtained.

For several years there has been a demand on the part of many members to avail themselves of this use of the publication, which is also the custom in all of the technical societies of this country which are issuing transactions, with one exception, notwithstanding that the annual dues of similar societies are two or three times that of this Association.

The interest of the Association has been shown by the large number of papers, and the discussions, the number of pages in the Transactions being 786, or 158 pages more than that of the previous year.

At the beginning of the year the membership was 459, and there have been 83 elected during the year, and the roll of membership has been diminished by the death of the following members:

WARREN M. ORSWELL, July 5, 1897.
RICHARD GARSED, July 27, 1897.
FRANK A. JENKS, Nov. 6, 1897.
CHARLES C. DIMAN, Nov. 7, 1897.
GEORGE W. BENSON, March 4, 1898.
THOMAS B. WATTLES, March 6, 1898.
JEREMIAH CLARK, April 22, 1898.

The resignations of nine and also the dropping of sixteen for non-payment of dues or the non-confirmation of election by ad-

mission fees, leaves the net membership previous to this meeting at 511. The election of the twenty-four candidates will bring the number at this meeting to 535. Although the membership has more than doubled during the last four years, there is an inevitable diminution from death and the mutations of life which has removed nearly twenty members per year.

It is hoped that the members will remember that it assists the headquarters very much to promptly reply on postal card receipts which are sent out with all Transactions issued from the office. The number of changes during the year in names or addresses on the list is 152 in addition to the insertion of 83 names of new members, and it is the endeavor of the Secretary and Treasurer to conduct this portion of the work on the basis of charging each member with whatever they are entitled to from the Association and crediting it with the postal card receipts as they come in. This is not stated in the spirit of complaint, because there has been great improvement in this respect, as when this system was first tried, after the Fall Meeting of 1894, less than one-third of the members sent replies.

Headquarters have been conducted on the same basis during the year and have been constantly visited by members for consulting the books or periodicals in the library, or attending to correspondence or business meetings. A number of business conferences between the members and others, and committee meetings have been held in the room during the year.

The Philadelphia Meeting was an occasion unprecedented in the history of the Association. A large local committee of persons in that city, but few of whom were connected with the Association, arranged an elaborate series of entertainments and attentions which have been as fully described as possible in the last volume of the Transactions.

At an informal conference of members at Philadelphia after the adjournment of the last meeting, the sentiment was expressed that such an occasion deserved more of a recognition by those in attendance than was possible in any resolutions of thanks, and this opinion was submitted to those who had attend-

ed the meeting, with the result that contributions were placed in the hands of the Secretary as Trustee to select and donate on their behalf a suitable testimonial to the Philadelphia Textile School as representing the centre of the courtesies received in that city.

A bust of GEORGE DRAPER was made from the sculptor's model for the marble bust at Hopedale, to which was added a base bearing suitable inscriptions, all of which was cast in bronze by the Gorham Manufacturing Company, and rested upon a polished column of Westerly granite bearing the seal of the Association. This was presented to the Philadelphia Textile School and unveiled with suitable ceremonies upon Saturday, April 16. A full account of the occasion of the unveiling of this testimonial is contained in an appendix to this report.

The Library has received several contributions during the past year and the following periodicals are received and kept on file:

LIST OF PERIODICALS KEPT ON FILE.

American Knit-Goods Review,	New York.
American Wool and Cotton Reporter,	Boston.
Boston Journal of Commerce,	Boston.
Cassier's Magazine,	New York.
Dry Goods Economist,	New York.
Electrical Review,	New York.
Engineers' and Power Users' Magazine,	Boston.
Engineering Record,	New York.
Fibre and Fabric,	Boston.
Home Market Bulletin,	Boston.
Iron Age,	New York.
Manufacturer,	Philadelphia.
Manufacturers' Gazette,	Providence.
Manufacturers' Record,	Baltimore.
Mill and Shop,	Boston.
Power,	New York.
Textile America,	New York.
Textile Recorder,	Manchester, Eng.
Textile Record of America,	Philadelphia.
Textile World,	Boston.

Other periodicals and occasional publications are sent to the Association and kept on file.

LIST OF TRANSACTIONS OF TECHNICAL SOCIETIES KEPT ON FILE.

American Society of Civil Engineers,	New York.
American Society of Mechanical Engineers,	New York.
American Institution of Electrical Engineers,	New York.
Boston Chamber of Commerce,	Boston.
Bureau of the American Republics,	Washington, D. C.
Gunton Institute Bulletin,	New York.
Consular Reports,	Washington, D. C.
National Association of Wool Manufacturers,	Boston.
National Electric Light Association,	New York.
Western Society of Engineers,	Chicago.

Respectfully submitted,

C. J. H. WOODBURY,

Secretary and Treasurer.

On motion of Mr. STEPHEN N. BOURNE, duly seconded, it was voted that the report of the Secretary and Treasurer be accepted and placed on file.

THE TESTIMONIAL TO THE PHILADELPHIA TEXTILE SCHOOL.

(Appendix to the Secretary's Report.)

The subscriptions which the members in attendance at the Philadelphia Meeting placed in the hands of the Secretary, as Trustee, for the purpose of furnishing a testimonial to the Textile School of the Pennsylvania Museum and School of Industrial Art, were devoted to a bronze bust of GEORGE DRAPER, of which the marble bust in the Town Hall at Hopedale, Massachusetts, by CYRUS COBB, furnished the model for this bronze, which was founded by the Gorham Manufacturing Company of Providence.

A base designed by a member of the Association on lines of the Ionic order, bears the following inscriptions:

On the Front.

A TESTIMONIAL TO THE
PHILADELPHIA TEXTILE SCHOOL
IN COMMEMORATION OF
THE SIXTY-THIRD MEETING
OF THE
NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION
OCTOBER, 1897

On the Right.

GEORGE DRAPER
1817 1887

On the Left.

MECHANIC
INVENTOR
MANUFACTURER
PUBLICIST

The bronze rests on a Roman Doric column of Westerly pink-white granite, polished throughout, and bearing the seal of the New England Cotton Manufacturers' Association, made by Messrs. Kavanaugh Brothers, of Boston.

This testimonial of the members of the Cotton Manufacturers' Association to the Philadelphia Textile School of the Pennsylvania Museum and School of Industrial Art, was presented on Saturday, April 16, in the auditorium of the Philadelphia Textile School, which had been decorated for the occasion with flags, flowers and palms.

The audience was present in answer to the following invitation which had been sent to those who had entertained the Association during the Philadelphia Meeting, and also to members of the Association.

The President and Trustees
and the
Associate Committee of Women
of the
Pennsylvania Museum and School of Industrial Art
request the pleasure of your company
Saturday, April Sixteenth, 1898,
at 3 o'clock,
at the
School Building, Broad and Pine Streets,
on the occasion of a presentation to the School,
by the New England Cotton Manufacturers' Association,
of a bust of GEORGE DRAPER,
of Massachusetts.

[The following communication was enclosed with the invitations.]

The New England Cotton Manufacturers' Association held its Fall Meeting in Philadelphia, in October, 1897, in order that its members might inspect the work of the SCHOOL OF INDUSTRIAL ART.

Its sessions were held in the Auditorium of the School, and

on adjourning the Association adopted the following resolutions:

Resolved, That this Association has studied with the greatest interest the work of the PENNSYLVANIA MUSEUM AND SCHOOL OF INDUSTRIAL ART, including the PHILADELPHIA TEXTILE SCHOOL, and desires to record in this way its high appreciation of the important service which this Institution is rendering to the cause of American Industrial Development. We feel that among the agencies which it is the worthiest aim of such associations as ours to promote and support, Industrial Education is of the first importance, and we warmly commend the spirit in which this magnificent School is conducted and the methods which characterize its teaching.

Resolved, That no better use can be made of public funds, or private munificence, or of the power that results from Association, than in the support of such institutions as the PENNSYLVANIA MUSEUM AND SCHOOL OF INDUSTRIAL ART.

Desiring to leave with the School some memorial that would worthily and permanently testify to the interest and appreciation, so well expressed in the above resolutions, the Association has caused to be executed and erected on a pedestal of polished granite, suitably inscribed, a bronze bust of the late GEORGE DRAPER, whose life and character as an ingenious inventor, a successful manufacturer, and a public-spirited and patriotic citizen, so well represent at once the ideals of the Association and the lessons for whose enforcement the School of Industrial Art exists.

It is for the presentation and unveiling of this memorial, on the sixteenth of next month, that the enclosed invitation is issued.

BROAD AND PINE STREETS,
PHILADELPHIA, March 31, 1898.

The meeting was called to order at 3 o'clock by Mr. WILLIAM PLATT PEPPER, Vice-President of the Pennsylvania Museum and School of Industrial Art, with the following introductory remarks:

Ladies and gentlemen: We are assembled here this afternoon to witness the presentation of the bronze bust of Mr. GEORGE

DRAPER, which is placed in our school by the New England Cotton Manufacturers' Association as a permanent testimonial of the high appreciation in which the work of this school is held by its members. In October, 1897, this Association held its meeting at the school on the invitation of the President and Trustees, and at the close of that session passed resolutions which are most valuable, as coming from experts, and are an endorsement of the aims and work of the Pennsylvania Museum and School of Industrial Art, including the Textile School, well worth having. We look upon the presentation of this fine and characteristic bronze bust as a most graceful compliment, and most heartily do the trustees and the Associate Committee of Women now tender their sincere thanks for the same.

PROF. L. W. MILLER, Principal of the school, read letters of regret from President RUSSELL W. EATON and Past President ARTHUR H. LOWE.

Mr. C. J. H. WOODBURY, Secretary of the New England Cotton Manufacturers' Association, made the following address of presentation:

The Sixty-third Meeting of the New England Cotton Manufacturers' Association at Philadelphia was an occasion unprecedented in our history of over thirty years. The numerous attentions received at the hands of Philadelphians, and the contributions to our Transactions by some of your eminent citizens, rendered the meeting a memorable one; and after the adjournment, an informal gathering of some of the members voiced the opinion that the remembrance of such an event, and the courtesies which graced the meeting, should not be allowed to pass by without a more permanent form of recognition than the resolutions of thanks. It was considered that this sentiment might be best expressed by a testimonial to the Philadelphia Textile School, at whose invitation the meeting took place in this city.

This suggestion was presented to those who had been in attendance, and contributions were supplied for the purpose without further direction than that it would be preferable that the testimonial should be a work of art in bronze, representative of the donors, and in harmony with the purposes of this institution.

The most careful consideration of all the possibilities and suggestions reverted to the adoption of the first thought that the bronze should portray some member of the Association whose career was a representative one of New England life in the cotton manufacture, and that one was a living force in the textile industry of America whose presence is as of yesterday.

GEORGE DRAPER, of Hopedale, was an illustrious example of what this testimonial is meant to represent. In the line of an honorable ancestry denoting skill, industry, and integrity, he followed in the footsteps of his forefathers. His common school education was supplemented by home instruction in mathematics to an extent which was unusual at that day outside of college life. In early life he toiled in a cotton mill and mastered the processes of manufacture, and also the work of repairing and installing cotton machinery.

While a young man he established the works which made Hopedale known wherever cotton is spun by power. The fertility of his mental resource is indicated by the fact that he received about one hundred patents, and beyond this his training and talents imparted a thorough mastery of the subject which enabled him to give the final touch which transmuted many other ingenious devices from failure to success. He was not an inventor of the type which seeks to convert an ideality into concrete form; he did not try to supplant old processes; but he was an original constructor, making devices for the desired purposes of improving existing methods.

His useful life work was indeed an answer to the apostrophe of Carlyle to Voltaire:

"It is true that you swing the torch to burn old abuses, but where, O, where, have you wielded the hammer to build new reforms?"

It is safe to say that the product of his works are in every cotton mill in America, and extensively used abroad, and his improvements constitute an essential feature in reducing cost or increasing production.

In the administration of his extensive affairs he was prompt, honest, and just. Prosperity blessed, but did not change him. He was a yielding man—as long as he had his own way—having wisdom to plan and force to execute the affairs entrusted to him.

A broader element of his nature of more permanent importance than his inventions, because in the progress of the art his inventions will be superseded by others, even as they took the place of what preceded them, was the ability in connection with the energetic exploitation of the product of his establishment, with which he advocated a keen analysis of the results from machines, and through this channel to increase the system and efficiency of mill supervision. Men who were brought up in his shops were sought for positions of responsibility and trust in cotton manufacturing, and before this Association, and in his daily meeting with members in business, the trend of his finely organized intellect was toward a higher standard of supervision and system in management, and the administration of the American cotton industry is improved through his efforts.

His active mind was not limited by his business, but reached out into public affairs, applying the same mental traits in embodying a purpose in the functions of government. Later in life the philosophic element of his nature became more prominent, particularly in political economy, in which he applied his power of analysis in application to every-day affairs. He mastered the principles of tariff and finance, and assimilated the problems so thoroughly that they became a part of his being to such an extent that he would replace conventional modes of expression by examples in terse phraseology peculiarly his own. He was especially active on matters pertaining to the establishment of the tariff on lines best adapted to the conditions of the American people. He founded the Home Market Club, and

was its first president, and devoted himself to its purposes. The endeavor has been made to indicate his biography in the inscription,

Mechanic.
Inventor.
Manufacturer.
Publicist.

Apart from the personality of the subject of the testimonial, we trust that you will accept it as representing in a slight measure a grateful feeling on the part of the members of the New England Cotton Manufacturers' Association and their guests in attendance at the Sixty-third Meeting, and also the sentiment of appreciation of this great textile institution, in the hope that its work may continue in the instruction which it is giving to the rising generation, in order that the range and standard of American textile manufacturing may continue to improve.

Mr. CHARLES H. HARDING of the Board of Trustees, accepted the gift on the part of the Museum in the following words:

Probably the first conscious function on the part of the human being is the acceptance of gifts; it may be done awkwardly, but it is likely to be positive and without restraint. Most people hope that, sooner or later, with abundant practice, they may, if they live long enough, graciously receive even the smallest gifts. But you bring us, Mr. SECRETARY WOODBURY, a gift that is unique, and that will therefore fill a large historical place; and proud as we are that you have chosen this our school as its resting place, I do most heartily accept it for our Board of Trustees, our Institution and the City of Philadelphia; and I beg you to believe that there is nothing wanting in our appreciation, however we may lack in its gracious expression.

That your Association should have been so impressed at your meeting here last October as to pass those resolutions, so carefully and skilfully drawn, has been to us a matter of great gratification; and that you select the work of this school, as the

thing in Philadelphia to be honored by this remarkable memorial of your visit is an additional matter of pride. And if you shall go on, in the spirit of your resolution that specifies such a school to be a "matter of the first importance", to your own Association: and shall found, promote, or foster any such thoroughly good and complete establishment in your own part of the country, we shall welcome it as an ally, rather than as a rival. Too long, indeed, was the Board of Trustees, this Faculty, this Associate Committee of Women, engaged in a work that was practically solitary in the United States; a work in which they have had all the struggle, all the weariness, all the uncertainty of future, that belongs to any great pioneer enterprise.

In another resolution, your Association declared "that to no more worthy object could there be devoted public funds, private munificence, or the power that comes from association" than the interests of such an institution. There is great keenness of discrimination in the order of association, for the ends in view, that has thus named the three great influences upon which alone such work depends for support and success; and it is right that the order should be "public funds, private munificence, and the power that comes from association". The work begun in a small way years ago, was, especially for the textile department, first the power that come from association; and then came the aid of private munificence. This building in which you find us to-day is largely ours, because of the handsome "private munificence" of one of Philadelphia's most successful and distinguished manufacturers, Mr. WILLIAM WEIGHTMAN. Everywhere you will find throughout the rooms here, gifts of machinery, models, and other applicances from "private munificance". Of public funds the institution has had but a meager and uncertain share. But we hope the day is not far distant when all education shall be regarded alike; that is, that the elementary branches of every kind of education ought to be a charge upon the public funds, with higher education depending in a measure upon the same support, largely assisted, however,

by private munificence and specific pursuit of following technical education cared for by the "power that comes from association."

You have chosen this school for the place of honor to which to entrust the care of this handsome bust of your distinguished member; and as I have said, you have hereby given a unique position to both. Some may think it is a far call from the Parthenon and Westminster Abbey to the halls of the school of Industrial Art. And I can imagine that hereafter people who go through those rooms, naming as they pass, portraits, pictures, and busts of musicians, poets, literati and warriors, may stop before this bust, asking "who is this, and what was he that I do not know or do not recall the face"? It is a proud omen for the rising honor that belongs to the skilful man that ministers to the cheap, beautiful, and plentiful supply of the second general need of the race (clothing, food being the first) that a hall is proud to receive this first of such monuments. And it is fitting that you should have chosen for this first erection, the bust of a man who represents specially the power of thought as applied to his industry.

Such a man, whose intentions and improvement constantly keep a thorn in the side of all manufacturing industry, by presenting what compels the installatfon of new machinery and methods, is a most useful factor in the promoting of the two great ends so desirable in manufacturing, "increase of production and lessening of cost".

In the days to come many a student, in passing by this bust, will take from it encouragement and stimulus in the thought that work well done for humanity in even these plain and peaceful lines taught in this school, will receive the like proud and fitting recognition, as does the life spent in devotion to literature, fine arts, statesmanship or war. In the name of our board and school, and our city, Mr. Secretary, I again heartily thank your Association for the distinguished mark of your kindly remembrance, and your esteem you confer upon us to-day.

ADDRESS BY COLONEL ALBERT CLARKE,

Secretary of the Home Market Club of Boston.

It is fitting that in the great manufacturing city of Philadelphia there should be placed a permanent memorial of one of the great manufacturers of New England. It is suitable that here, where BENJAMIN FRANKLIN and MATTHEW CAREY laid broad and deep the foundations of unexampled national prosperity, there should come as a permanent guest the bronze presentment of one who profited by their teachings and did more than most others to disseminate them. Here this mute but speaking witness finds illustrious company in the invisible presence of HENRY CHARLES CAREY, WILLIAM ELDER, WM. D. KELLEY and SAMUEL J. RANDALL, and in the visible presence of HENRY CAREY BAIRD, JAMES M. SWANK, THEODORE C. SEARCH, CHARLES EMORY SMITH and CHARLES HEBER CLARK, all of whom have long stood in the front ranks of the promoters and defenders of a national economic policy.

GEORGE DRAPER was a good example of the fruitage of "Poor Richard's" maxims. He made his fortune and made his mark. Born in Weston, Massachusetts, in 1817, and reared upon a farm, his college was the district school, and his athletic field the wood lot and the corn field. Having a mechanical turn at the age of fifteen, he took a position under his older brother in the weaving department of the cotton mill at North Uxbridge. He mastered every detail of the processes in all departments of the mill and was soon appointed overseer in one of the largest of the fine cotton mills of the country, at Three Rivers, Mass. There he made his first invention, which was of an improvement in a temple for weaving that had been invented by his father.

In 1839, owing to a general depression in manufacturing business, caused by the progressive reduction in duties in CLAY'S Compromise Tariff, an illustration of the Latin proverb,

facilis descensus averni est, he was thrown out of employment as were most of the skilled operators of New England. After looking vainly for work as an overseer or superintendent, and having consumed his small savings and incurred a debt of several hundred dollars, he finally courageously and gladly accepted a position as an operative in Lowell, at the remuneration of five dollars a week. This experience convinced him of the advantage to laboring men of a protective tariff, and he never ceased to study the subject and to impress his views upon his associates.

Soon after the improved tariff of 1842 went into operation, he again became an overseer, the next year a designer, two years later superintendent of one of the mills of the Otis Company at Ware, and soon manager of the entire concern.

In 1853 he removed to Hopedale, which was his home during the remainder of his life, and in partnership with his brother laid the foundations of what has long been one of the largest cotton machinery manufactories in the world. Uninterrupted prosperity attended the business. Upon the retirement of his brother in 1868, he took into partnership his eldest son WILLIAM FRANKLIN DRAPER, who had returned from the Civil War with the scars of two severe wounds, and with the rank of brigadier general, and who is now United States Ambassador to Italy; later his other sons GEORGE A. and EBEN S. became partners, all of them emulating the example of their father in study, in industry, and in sterling business qualities. Subsequently two grandsons became partners, and recently the partnership has been changed to a corporation, admitting some of the long time competent and faithful employees. It is the proud boast of this establishment that it never had a labor difficulty, that its paper never went to protest, that it never had to take back or deduct from the price of a machine because of any defect in its construction, and that the inventions of its members, or of others which it promoted, have reduced the cost to mankind by more than one-half.

Among GEORGE DRAPER'S inventions were devices for self-acting temples, eveners for railways heads, parallel motions for

looms, self-lubricating bearings for spindles, and warpers for beaming yarn. The first great improvement in spindles was invented by J. HERBERT SAWYER, of Lowell, in 1871. The next was by F. J. RABBETH, of Pawtucket, in 1878. These were the foundations for many further improvements by the DRAPERS until 1893, when General DRAPER, in an historical address at the Columbian Exposition in Chicago, summed up their economic value to the world, that is, their saving in the cost of production, as equivalent to more than fifty millions of dollars in ten years.

Since then the company has added to its marvellous devices an automatic stop for looms when the warp thread breaks, and an automatic shift of the bobbin when the thread runs out, without stopping the loom. These two reduce the cost of weaving some 50 per cent., and are rapidly coming into general use for plain goods.

GEORGE DRAPER is recorded on this monument as a publicist. He was that indeed, and yet probably no other publicist ever personally wrote or published so little as he did. It was nearly all during the closing years of his life, after he had thrown off many business cares, but I do not doubt that if he had not suddenly been taken away in June, 1887, he would have produced something far more comprehensive and permanent than the newspaper articles and pamphlets upon protection which he had begun to turn out. But he did far more than he could ever have done with his own pen. He so impressed upon some of his business acquaintances the need of popular education in the principles and working of protection, and of the importance of continued and permanent work in that direction, that a few months before his sudden decease they formed the Home Market Club and he became its first president. The club was chartered under the laws of Massachusetts, and on Mr. DRAPER'S suggestion it adopted the motto "American wages for American workmen, American markets for the American people; protection for American houses". The motto, however, did not circumscribe its policy. It has always favored all such trade with

foreign countries as can be carried on to mutual advantage. Though called a "club" it is rather an economic association, for it maintains only a business office in Boston, and has no social functions except to give annual dinners, and these are more educative than social, for they bring together the largest gatherings of solid men ever assembled in the United States for a similar purpose, and are graced by the presence and oratory of the nation's most famous statesmen. The real work of the club, however, is upon lines laid down for it by Mr. DRAPER, in keeping a bureau of information on every phase of the great tariff question, furnishing such information free of cost to all inquirers in all parts of the country, and the investigation of political science and the disseminating of correct ideas upon the same. In fulfilling this last mentioned purpose it has, during the ten years of its existence, circulated throughout this country the equivalent of nearly one hundred million pamphlet pages of good literature in favor of protection and honest money. It is not endowed. It depends entirely upon the voluntary and usually small contributions of its members, but it is the largest association of its kind in the world, and it never pleads or presses for support. Its monthly journal, *The Home Market Bulletin*, is now found in nearly all the great libraries, in the offices of newspapers and of business men, and in the houses of mechanics and farmers in almost every State.

It was in founding that institution that GEORGE DRAPER did the most to earn the title of publicist, and yet whoever reads his writings sees that he possessed the qualities which would have made him famous had not his work in this line been cut off untimely. A few brief extracts will best show the quality of his thought and the lucidity and directness of his style. The leading free trade organ in New England is the *Boston Herald*, and that paper has continually sought to prejudice the people against the "protected industries". In a letter to the *Commercial Bulletin*, Mr. DRAPER made the point that many industries enjoy a national protection which is greater than any protection which can be afforded by a tariff, and he said:

"I will mention some wholly protected industries. For one, take a daily newspaper, say the *Boston Herald*. That is more completely protected against foreign competition than any article can be by custom duties as the laws are administered. The ocean is an insuperable barrier to printing any paper in a foreign country and sending it to Boston in time to give the earliest local as well as general news. Now I claim that the publishing of that journal is a wholly protected industry, and that any industry which can be interfered with by importations from abroad, or which depends upon tariff duties to wholly or partially prevent such importations from abroad, is less protected than the *Boston Herald* establishment".

Why the wholly protected cry out against protection to others in the interests of common prosperity? Let anyone draw the lines between the wholly and partially protected industries and he will see that those who are not protected by law are better protected by natural causes.

The most dangerous free trade agitation in recent years took the form of a demand for free raw materials. Mr. DRAPER was one of the first to denounce it to his fellow manufacturers as unjust, illogical, and short-sighted. He said, "I am not engaged in either the manufacture of iron or steel; but the manufacturing concerns I am largely interested in buy and use thousands of tons a year. I do not, for one, desire to have the duty reduced on iron and steel, because I believe it is for the best interests of the people of this country to keep and supply our own markets for such material; and when any amount is imported, it shows that our manufacturers have no monopoly of the business, and that home competition will prevent too high prices. Protectionists, or those who want the American market for the American people, must stand together or fall separately. I have no sympathy for those who want protection for their own industry at the expense of other industries as necessary as their own. By protecting our own market we promote diversified industry, and create and maintain a demand for skilled labor, which, in turn, calls for increase in all kinds of labor; and the

effect of holding our own market, imperfectly, even, has been to make this the best market for skilled labor in the world."

To counteract the evil and dangerous prejudices which political demagogues endeavor to create against capital and to show the vast importance of constant and remunerative employment for the people, Mr. DRAPER wrote this true and philosophic paragraph:

"Accumulated wealth of the country is certainly a great boon in many ways; but the accumulation of property that is being consumed in a given community is vastly more important. The day's work of a nation is of vastly more importance to the statesman than the accumulated wealth of a country — our country, at any rate. I am confident that when business is good and the people fully employed, they will earn as much probably in two years, certainly in three years, as all the accumulated wealth of the country. My experience teaches me that the more industrious a nation is, the better educated, the more moral and thrifty it will be. If I am right in this, then the principal object of statesmanship should be to so legislate as to promote the greatest amount of protective industry among the people."

Mr. DRAPER was not only a worker, a great captain of industry, an economist and an organizer whose plans work out results after he is at rest, but he was a kind-hearted and benevolent man, a public spirited citizen and a patriot. He aided his employees to acquire beautiful homes of their own. He took pride in his village and gave it one of the finest town halls in the commonwealth. Before the civil war he was an abolitionist, a co-worker with GARRISON and PHILLIPS, with GARRETT SMITH of New York and with ROBERT PURVIS of this city, whose death yesterday, we mourn to-day. After the war broke out he organized and equipped several companies of volunteers, paying their early expenses, bestowing gifts upon the men and looking after the comfort of their families. Though never accepting office, excepting possibly in town affairs, he took an active part in politics and sometimes went as a delegate to conventions. He

held that it was treason to neglect to vote and he never hesitated to espouse an unpopular cause if he believed it right. He was a total abstainer from liquor and tobacco, a Unitarian in faith, a friend of every worthy cause, a noble and strong character, and the New England Cotton Manufacturers' Association has done the youth of Philadelphia a great service by giving them the inspiration of his life in the form of the bronze reminder and it is most appropriately placed in this institution of art and textile instruction, which is leading the procession in our national march to higher industrial success.

Forever may it remain here as a monument of what personal character, high endeavor, and lofty public spirit can do in a great free country of unequaled opportunities and of the best incentives to real success and the fame of a good influence that remains.

The audience then assembled in the rotunda of the building, where the testimonial was unveiled by Mrs. E. D. GILLESPIE, of Philadelphia, on behalf of the Woman's Auxiliary Committee, who made an address, largely referring to manufactures among her New England ancestry of five generations ago, and to the example and encouragement which would be afforded to the students of the school by this testimonial.

After the ceremonies, those present were conducted through the Textile School.

MECHANIC
INVENTOR
MANUFACTURER
PUBLICIST
A TESTIMONIAL TO THE
PHILADELPHIA
TEXTILE SCHOOL
IN COMMEMORATION OF
THE SIXTY THIRD MEETING
OF THE NEW ENGLAND
COTTON MANUFACTURERS'
ASSOCIATION,
OCTOBER, 1857.

THE PENNSYLVANIA MUSEUM

AND SCHOOL OF INDUSTRIAL ART,

PHILADELPHIA.

At the meeting of the Executive Committee of the Pennsylvania Museum and School of Industrial Art, held April 14, 1898, the following resolution was unanimously adopted:

Resolved, That the presentation to this institution of a bust of GEORGE DRAPER, of Massachusetts, by the members of the New England Cotton Manufacturers' Association, indicating, as it does, a desire to associate the memory of a distinguished citizen with the work of this School of Industrial Art, is gratifying in the extreme.

Resolved, that the sincere thanks of the Officers and Trustees are hereby extended to the members of the above Association for their graceful and significant gift.

DALTON DOW,

Secretary.

The PRESIDENT. Next on the order of exercises is the election of officers. There are to be chosen at this meeting a president, two vice-presidents, two directors to serve three years, and one director to serve out the unfinished term of two years, Mr. RICHARDSON being appointed by the Board of Government to serve only one year, following Mr. SOUTHWORTH'S election, Mr. SOUTHWORTH having declined the office, being obliged to give it up on account of pressure of business.

Mr. EDWARD W. THOMAS. I move that a committee of five be appointed by the chair to nominate in a list of officers.

The PRESIDENT. It is moved that the chair appoint a committee of five to bring in a list of officers. Following out our usual custom, that committee will report at the last session.

The motion was carried, and the President appointed the following gentlemen: Messrs. EDWARD W. THOMAS, of Lowell; STEPHEN N. BOURNE, of Manchester; WALTER E. PARKER, of Lawrence; COL. J. H. KENDRICK, of Providence; GEORGE OTIS DRAPER, of Hopedale.

"Flax Culture and the Manufacture of Linens to Take the Place of Coarser Cottons in New England," by JONES S. DAVIS, Holyoke, Mass., was read.

Discussed by Messrs. F. E. CHAPPELL, SAMUEL WEBBER, EDWARD ATKINSON and ROBERT MCARTHUR.

SECOND SESSION.

WEDNESDAY, APRIL 27, 1898.

Meeting called to order at 2 P. M. President EATON in the chair.

The following papers were read:

The Prior Roller Cotton Gin.

THOMAS W. PRIOR, Philadelphia, Pa.

Discussed by Messrs. THOMAS W. PRIOR, STEPHEN A. KNIGHT, EDWARD ATKINSON.

The Round Bale at the Mill.

STEPHEN N. BOURNE, Manchester, N. H.

One Hundred Years of Ginning and Baling Cotton.

GEORGE A. LOWRY, Boston, Mass.

Discussed by Messrs. EDWARD M. WELD, ROBERT R. SMITH, JOHN E. PREST, STEPHEN A. KNIGHT and EDWARD ATKINSON.

The Excelsior Spinning Frame.

ABEL T. ATHERTON, Pawtucket, R. I.

TOPICAL QUESTION.

91. Can a systematic method of costs be determined for weaving?

Discussed by Mr. CHRISTOPHER P. BROOKS.

The discussion of Topical Question No. 92, "Where is the economical range that ring filling frames may be used in competition with mules; that is, the lowest and highest number of yarn?" was postponed.

TOPICAL QUESTION.

93. In large manufacturing plants, having a number of rooms on each principal operation, which is the better, to have one overseer or department man in charge of each special operation, or to have a larger number of men in charge of smaller sections?

Discussed by Messrs. ARTHUR H. GULLIVER, JOHN ECCLES, O. B. PARKER, JOHN E. PREST, T. W. WILMARTH, RUSSELL W. EATON, STEPHEN A. KNIGHT and ROSCIUS C. NEWELL.

THIRD SESSION.

THURSDAY, APRIL 28, 1898.

Meeting called to order at 10 A. M., President EATON in the chair.

Steaming Filling.

EDWARD A. MONGEON, Blackstone, Mass.

The PRESIDENT. Before proceeding with the discussion of Mr. MONGEON'S paper I will take this occasion to ask the committee on the nomination of officers for the next year to make their report. I will ask Mr. Parker to report.

Mr. PARKER. Mr. President, the committee on nominations beg leave to report that they recommend the election of the following officers:

President.

STEPHEN A. KNIGHT, Providence, R. I.

Vice Presidents.

FRED C. MCDUFFIE, Boston, Mass.
HENRY T. WHITIN, Northbridge, Mass.

Directors for three years.

GEORGE F. WHITTEN, Manchester, N. H.
JOHN TEMPEST MEATS, Taunton, Mass.

Director for two years.

CHARLES H. RICHARDSON, Clinton, Mass.

The PRESIDENT. Gentlemen, you hear the report of the committee on nominations, and if it is your pleasure that this report be accepted you will manifest it by saying aye.

The motion was unanimously carried.

The PRESIDENT. The constitution provides that the election of these officers shall be by ballot, and following out the course of the last few years, printed ballots in accordance with the recommendations of the committee will be distributed, and later will be gathered by the committee and a report of the election by ballot will be made at the last session of the meeting this afternoon.

The paper on Steaming Filling was discussed by Messrs. O. B. TRUESDELL, ROBERT R. SMITH, STEPHEN A. KNIGHT, EDWARD A. MONGEON, JOHN E. PREST, RUSSELL W. EATON, JOHN K. RUSSELL, FRANK M. MESSENGER, THEOP. W. WILMARTH and JOHN ECCLES.

The Shuttle Shifting Loom.

RANDOLPH CROMPTON, Worcester, Mass.

Discussed by Messrs. EBEN S. DRAPER, JUSTIN A. WARE, WILLIAM EVANS and JOHN E. PREST.

Slashing.

GEORGE F. TRYON, Fall River, Mass.

Discussed by Messrs. EDWARD ATKINSON, JOHN ECCLES, GEORGE F. TRYON, FRANK M. MESSENGER, WOODBURY K. DANA, O. B. PARKER, WILLIAM O. SMITH, CHANNING WHITAKER, ROSCIUS C. NEWELL and STEPHEN N. BOURNE.

The Bastard Reed for Cotton Weaving.

ARTHUR PARKINSON, New York, N. Y.

TOPICAL QUESTIONS.

94. What is the best method of treating belts, and their proper care?
95. What is the best method of utilizing the waste products of a mill?

were laid over until the sixty-fifth meeting of the Association.

FOURTH SESSION.

THURSDAY, APRIL 28, 1898.

Meeting called to order at 2 P. M., President EATON in the chair.

Our Export Trade in Cotton Goods.

CHRISTOPHER P. BROOKS, Lowell, Mass.

The Nicaragua Ship Canal.

GARDINER C. SIMS, Providence, R. I.

Discussed by Messrs. WILLIAM S. GRANGER and CHRISTOPHER P. BROOKS.

Cotton Mill Costs.

WILLIAM WHITTAM, JR., Charlotte, N. C.

Read by title and will be taken up for discussion at the sixty-fifth meeting.

Early Inventions upon Copper Printing Rolls.

COL. SAMUEL WEBBER, Charlestown, N. H.

Mr. GEORGE P. GRANT, JR. offered the following on textile education.

Whereas, The interest aroused in organized technical instruction in textile manufacture by papers presented, discussion had, and resolutions adopted from time to time by this association of New England Cotton Manufacturers is bearing fruit in the establishment of textile schools,

Therefore, *Resolved*, that we heartily and earnestly commend textile education to the fostering care of the governments of the New England states, and invoke their substantial aid therefor in this, the hour of severest competition this leading industry has ever met.

Resolved, That we are gratified that a textile school has been established at Lowell on such broad and comprehensive lines as the needs of the industry require, and that it is being developed in its several departments under the immediate personal supervision of New England textile manufacturers representative of the New England Textile industry, and thoroughly experienced in management, and the various processes of the industry.

Resolved, That the members of this Association visit the Lowell Textile School on Friday, April 29th.

Resolved, That the Board of Government be requested to take into consideration the subject of textile education, and report at the next meeting of the Association.

On motion of WALTER E. PARKER, duly seconded, the resolutions were unanimously adopted.

What I Don't Know About a Cotton Mill.

MALCOLM CAMPBELL, Woonsocket, R. I.

Discussed by Messrs. FRANK M. MESSENGER, HAROLD LAWTON and O. B. PARKER.

TOPICAL QUESTIONS.

96. In which class of machinery, as at present running, is it desirable to improve the most to obtain a minimum cost in manufacturing?

Discussed by Messrs. ARTHUR H. GULLIVER, O. B. PARKER and FRANK M. MESSENGER.

97. What is the best method of cleaning mill windows?

The Secretary read a communication from HERBERT L. MOODY of New York.

98. What advantages does an electric motor possess over a transmission dynamometer for measuring the power required to drive textile machinery?

Discussed by Messrs. E. B. RAYMOND and CALVERT TOWNLEY.

99. What is the best taper or length of wind for mule cops on No. 37 filling?

Was laid over until the sixty-fifth meeting.

Mr. WALTER E. PARKER, chairman of the committee on nominations, reported that 41 ballots were cast for each of the names on the ballot:

President.

STEPHEN A. KNIGHT, Providence, R. I.

Vice Presidents.

FRED C. MCDUFFIE, Boston, Mass.
HENRY T. WHITIN, Northbridge, Mass.

Directors for three years.

GEORGE F. WHITTEN, Manchester, N. H.
JOHN TEMPEST MEATS, Taunton, Mass.

Director for two years.

CHARLES H. RICHARDSON, Clinton, Mass.

The PRESIDENT. You hear the report and I declare the gentlemen as named elected as officers for the ensuing year. Mr. PARKER will you kindly couduct Mr. KNIGHT to the platform.

[Mr. STEPHEN A. KNIGHT, president elect, was conducted to the platform by ex-president WALTER E. PARKER.]

Ex-President Mr. RUSSELL W. EATON. I have the honor, gentlemen, to present to you the president for the new year, STEPHEN A. KNIGHT, of Providence.

President STEPHEN A. KNIGHT. Gentlemen of the Association, I highly appreciate the compliment that you have paid and

the honor you have bestowed in choosing me for your president for the coming year. I think that in this particular case the office sought the man rather than the man the office. I have been urged quite frequently for the last two years to accept this position, but have felt that there were many members in the society much better qualified to perform that duty than myself. But I have been constrained to act about as the woman did who had frequent proposals which she constantly refused, but after a time she was induced to accept, and she married the man who had so often proposed. The question was asked by her friends as to how she came to change her mind, and she said she married him to get rid of him. Well, now, I have accepted the office somewhat for the purpose of getting rid of the constant urging to accept the position. I really do not know why there has been any urging of me in that direction except it was my venerable condition. However, it seems to be the unanimous desire of the society, and I accept.

I believe the Board of Government to be a very important factor in the success of this society. I am sure that the old, and I sincerely hope and trust that the new, members of that Board will lend to me their hearty support and co-operation. Our honored and always alive secretary I know will do the best he can for me. And may I just urge that the members at large, the laity perhaps, properly speaking, will also lend me their assistance. I believe that each of you, owing to the privilege and opportunity granted by your superior officers in attending these meetings, is somewhat indebted to them, and they expect of you something in return for your absencc from your place of business; and I know of no way, it strikes me there is no way, that there can be so much gained by each of you, as to participate in the papers, arguments and debates that are presented to the meeting. I believe that each and every one of you would have a very mnch deeper interest, in fact, you don't know how much more interest you would have in these meetings, how much better you would feel, if each of you would contribute something for our information. You all have expe-

riences, you all have knowledge, and it is the mingling of these experiences and this knowledge that is the object of this society. I feel that the society has great opportunities. There is very much that we can do to promote the interests that we represent, and the best manner in which we could promote that interest is for each and every one to feel that he has something to do, if it is ever so little. I am really hoping that for the year to come the members generally will send us in propositions to be discussed; that they will write papers, suggest topical questions, and feel free to say and do anything that would interest them in the meetings that we semi-annually hold. I trust that the Board of Government, and our Secretary, and you, gentlemen, as lay members, will lend me your assistance, and I will do the best in my power to make the meetings of the coming year what they have been for years past, meetings of success. [Applause.]

Voted to adjourn.

Adjourned.

Attest:

C. J. H. WOODBURY,
Secretary.

THE VISIT TO THE LOWELL TEXTILE SCHOOL.

In accordance with the invitation of the Trustees of the Lowell Textile School, a number of the members of the Association left Boston in a special car at 9.35 on Friday morning, April 29, from the Union Station, where they were met by Mr. C. P. BROOKS, director of the school, and proceeded to Lowell, where they were met by a committee consisting of Messrs. H. S. PERHAM, A. S. LYONS, E. S. THOMAS and JAMES T. SMITH, and with other Lowell gentlemen were conducted through the school, where they spent one and one-half hours in inspecting the equipment of the institution and the methods of instruction.

Later in the day lunch was served at the Board of Trade rooms, after which informal remarks were made by COL. SAMUEL WEBBER of Charlestown, N. H., Mr. THOMAS WALSH of Lowell and his Honor, JAMES W. BENNETT, Mayor of the City of Lowell.

TRANSACTIONS.

FIRST SESSION.

WEDNESDAY, APRIL 27, 1898, 11 A. M.

The Association met in Chipman Hall, President EATON in the chair.

The PRESIDENT. We have a paper prepared by Mr. JONES S. DAVIS, of Holyoke, Mass. Mr. DAVIS is here and I will ask the Secretary if he will kindly escort Mr. DAVIS to a seat on the platform. Mr. DAVIS is one of the original members of this Association.

[Mr. DAVIS was escorted to the platform by the Secretary.]

If you will kindly give your attention the Rev. Mr. CHAPPELL will read Mr. DAVIS' paper.

Mr. T. E. CHAPPELL. I wish it distinctly understood, gentlemen, that cotton manufacturing is not in my line of business, and that if there be any meat in this paper, if it have anything of value or suggestion to you in your business, it is due to Mr. DAVIS. Perhaps I should say that Mr. DAVIS, as many of you know, was one of the first members of this Association. He was the Secretary of the first meeting called for the organization of the Association, and was one of its first directors. Mr. DAVIS is, or

has been, one of the veterans in cotton manufacturing in New England, and some of the older members of the Association may know something about his enterprise and his ability. Let me say that though Mr. DAVIS is in his eighty-first year, his mind is active and alert. I imagine that no man among you reads with any greater interest the doings of this Association or anything that has to do with cotton manufacturing. He is very much alive in mind, let me assure you, and very much interested in whatever interests you.

I will say that it is my conviction that Mr. DAVIS' reminiscences, that might be condensed into ten or fifteen minutes, would be worth much more to you in many ways than the paper; consequently I am going to abbreviate the paper and give you time, if you desire, to ask him any questions about early cotton manufacturing in New England. He is among the first who had a hand in it, and he is certainly a most interesting character to talk with.

Mr. DAVIS has been interested for more than twenty years in the culture of flax, in the manufacture of linen goods from flax fibre especially. At the time that he was agent for the Lyman Mills in Holyoke he visited Europe in the summers of 1850 and 1851, for that corporation, in the interests of a study of the manufacture of flax in Ireland, Belgium and in other countries on the continent, for the purpose of finding out whether that corporation would best engage in that business at that time. Mr. DAVIS made a very careful study of the flax fibre industry at that time and became very much interested in introducing it into this country. A combination of causes that are developed in the paper has prevented that so far; but Mr. DAVIS in his old age turns to his first love, and believes that the manufacture of linen goods from flax fibre is to be one of the great industries of this country in the future. And so he has brought together, with my collaboration, and with the aid of Mr. CHARLES RICHARDS DODGE, of the Fibre Investigation Committee of the National Board of Agriculture, and with the aid of Mr. HENRY GOODELL of the State Agricultural College, not only the knowl-

edge he has gained by personal experience in this matter, but whatever can be gleaned from the libraries that has to do with this subject and from gentlemen who have taken great pains to investigate it. Mr. DAVIS wishes the title of his paper to be, "Flax Culture and the Manufacture of Linens to Take the Place of Coarser Cottons in New England."

Mr. T. E. CHAPPELL read the following paper:

FLAX CULTURE AND THE MANUFACTURE OF LINENS TO TAKE THE PLACE OF COARSER COTTONS IN NEW ENGLAND.

JONES S. DAVIS, Holyoke, Mass.

In the proceedings of this Association for several years back we find Southern competition in the manufacture of coarser cottons mentioned with growing emphasis. This is not the time to discuss in detail the causes which enable Southern manufacturers to compete successfully in the making of the lower grades of cotton goods. Some of these causes are well known to you all, while others are as yet only vaguely apprehended even by the Southerners themselves. Recognizing the fact, it is our purpose today to inquire what we shall do about it.

The phenomenal progress of this country in manufactures has been due very largely to the American principle of the greatest diversification of industries, coupled with the national policy of encouragement to the introduction of new enterprises. The purpose of this paper is to call the attention of this Association to a possible industry of very great magnitude, an industry but little understood or valued in this country at the present time, but which in Colonial days, and for a decade after the Revolutionary War, ranked among the chief industries of the country. I refer to the culture of flax and the manufacture of linen goods.

It may be of interest to refer briefly at this point to the history of the flax industry in this country. The art of raising flax and spinning it by hand was brought to this country by the earliest colonists. In 1629 the English parliament directed that flax should be cultivated for fibre in Massachusetts. As early as 1648 the plant was cultivated in Virginia by Captain MAT-

THEWS. Almost every housewife in the Colonies wove linens by hand. In 1790 the Secretary of the Treasury reports that the manufacture of linen goods in a household way had become an established industry. It will be remembered in this same year, 1790, the first cotton mill was inspected by GEORGE WASHINGTON. Thus linen manufacture antedates that of cotton in this country by nearly 150 years. It may be said in reply to this statement that the linen industry was of little consequence at this early date. But 30 years before the erection of the first cotton mill Massachusetts and Rhode Island in a single year reported nearly 30,000 yards of linen fabrics made in families. All the records in New England show a disposition to encourage the growth and manufacture of flax.

A half century before the manufacture of cotton, Pennsylvania, Rhode Island, and New York also offered special inducements for the manufacture of certain kinds of linen goods. In 1810 over 20,000,000 yards of linen fabrics were made in this country in families. In addition to this nearly 25,000,000 of yards of linens of coarser quality were made. Water and steam power as well as labor-saving machinery had been introduced previous to this, which resulted in a considerable extension of the industry. But it was still largely a household industry. The following statistics taken from report number 9 of the Fibre Investigations of the United States Department of Agriculture, by Mr. CHARLES RICHARDS DODGE, Special Agent of the Government, will be of interest. In 1849, 562,312 bushels of flax seed were harvested in the United States and 7,709,676 pounds of fibre were produced. In 1859, 566,867 bushels of seed were harvested and 4,720,145 pounds of fibre. In 1869 the production of seed had risen to 1,730,444 bushels, while the fibre in this year rose to the phenomenal total of 27,133,034 pounds, an amount never approached since. In 1879, the production of seed was nearly four times the quantity for the year 1869, while the production of fibre fell to the comparatively insignificant quantity of 1,665,546 pounds. In 1889, 12,250,410 bushels of seed were harvested. The production of fibre had fallen stead-

ily during this period until it reached 241,389 pounds in that year.

The reason for the falling off in the production of fibre since 1869, while the acreage of flax and the production of seed were rapidly increasing, is not far to seek. The impetus given to cotton manufacturing by the invention of the cotton gin and subsequent mechanical improvements, soon brought down the price of cotton fabrics through the sharp competition among manufacturers which followed on the rapid expansion of the industry. Little by little the cheaper cottons have found their way into the homes, silencing the spinning wheels and almost all the looms engaged in the manufacture of the finer linens. At the present time the use of flax fibre in this country is chiefly in the making of twines, bagging, and the coarser fabrics to which our other fibres are not so well suited. In certain parts of Kentucky and the Virginias the household industry still flourishes. But this is chiefly in the backwoods districts, which still cling tenaceously to the old ways. The manufacture of the finer fabrics by machinery is confined almost exclusively to experimentation.

In spite of the decline of the linen industry the culture of flax has steadily increased in this country. At the present time it is grown almost exclusively for seed. The straw is of no value except in making certain coarse qualities of bagging and of paper. Since 1889 the acreage of flax sown has fluctuated somewhat. This is due, doubtless, to fluctuation in the price of flaxseed oil and flaxseed cake during this period. The acreage sown has been affected somewhat, no doubt, by the very general impression that flax is an exhausting crop. At the present time the annual production of flaxseed and straw is approximately 12,000,000 bushels of seed and 300,000 tons of fibre. It is doubtful, however, if our farmers can continue to grow flax indefinitely for the seed alone. Unless some use can be made of the fibre this great agricultural industry will doubtless suffer a considerable decline during the next decade. Is it not possible that the manufacturers of this country may prevent this

decline? Manifestly, the surest and easiest way to do this is to find some use for this nearly half a million tons of flax straw produced annually in this country.

Let us, then, ask and attempt to answer two important questions about this matter. First, If the use of this enormous quantity of flax-fibre is possible to us, will it pay? Second, What considerations enter inter into the production of flax in this country that favor the use of the fibre in the manufacture of linen goods?

First, then, will the manufacture of linen goods pay? It is conceded that next to cotton, flax is the most useful and valuable of all commercial fibre. It was though at one time that cotton goods, on account of improved methods of manufacture, might eventually almost entirely take the place of linen goods. But plainly, this is not to be. More and more flax is coming to be again what it was from the time of the earliest Pharaohs of Egypt to the beginning of the present century, the fibre of luxury, while cotton fibre is taking its place as the fibre of the masses. We are importing annually from foreign countries over $30,000,000 worth of linens — more than one-tenth of our total output of manufactured cottons. It has been estimated that the world's consumption of linen goods is not far from one-third the consumption of cotton goods in money valuation. It must be evident that any country that pretends to lead in the manufactures of the world can ill afford to have no part in this important branch of human industry. One need only to visit the great centres of linen manufacturing in Ireland and on the Continent to be convinced that next to the manufacture of cotton goods this is the most remunerative of the fibre industries. A study of the comparative consumption of linens and cottons shows that with the steady rise in the standard of living of the masses in civilized countries, the per cent. of linen goods used is steadily increasing. To one in possession of the facts about this great industry, and especially about its early establishment in this country, it must be a matter of great surprise that this en-

terprising nation has allowed this industry to slip from its control.

Mr. CHARLES RICHARDS DODGE, one of whose reports was referred to earlier in this paper, has urged upon our government and upon our manufacturers the great importance of the reinstatement of linen manufacturing on a large scale into this country. He has expressed the opinion that if we go about the matter intelligently, moving only so fast and so far as we can see our way clearly, the industry may come in a few years to rank among the first in our country. He has made a most careful and exhaustive study of flax culture and the manufacture of linens in Ireland, in Belgium, in Russia, and elsewhere upon the Continent, and is prepared to speak with authority. For nearly ten years he has been the special agent of the Department of Agriculture in their investigations into the culture and manufacture of fibres and fibre fabrics. He has repeatedly urged in the nine reports issued by him with reference to flax culture in the United States and abroad, that it would be profitable for the United States to engage largely in the manufacture of linen goods.

In his first report he says, " If fine flax could be produced by the American farmers in the past there is no reason why they cannot do the same thing today, so far as soil and climate are concerned ". " Capital has become interested and several new manufacturing concerns have been established. Inventors are studying the needs of the industry, in the line of labor-saving devices for economically harvesting and saving the fibre, and the farmers themselves are interested, though hesitating to embark in this culture until better acquainted with existing conditions and the requirements of the culture. The time is propitious, as flax culture in the old countries is steadily declining, because under the antiquated and laborious methods of culture there in vogue, with enormous rentals demanded for the land, flax culture no longer pays save in favored localities ". Many other special investigators unite with Mr. DODGE in the opinion

that the manufacture of linen goods in this country may easily become one of our chief industries.

We come now to our second question, What conditions or considerations enter into the production of flax in this country that are favorable to the use of the fibre for the manufacture of linen goods?

Certain agricultural conditions have been referred to briefly. The most important of these is the cheapness of lands compared with values in Ireland and on the Continent, where flax is now most largely produced. Next to this in importance is the greater native fertility of our soils. A yet further condition in our favor, especially in New England, is the fact that thousands of our best farms have been abandoned and ten thousands of acres of land, of much higher native fertility than those under cultivation in Europe, now lie in idleness or practically so. These conditions, joined with the proverbial skill and enterprise of American farmers, should give us a decided advantage in this enterprise over European competitors. We need only learn their methods of close and intense farming to surpass them easily in the growth of flax; at least to the extent of providing fibre for the production of linen fabrics for home consumption. During the last few years the United States Department of Agriculture, through the various state experiment stations, has made extensive experiments in the growth of flax. These experiments have demonstrated that flax can be successfully grown for fibre in almost all the states in the Northern half of the United States. During this period of investigation, and for many years previous, sufficient flax had been grown in certain parts of this section of our country to furnish fibre for the manufacture of very much more linen goods than were consumed in our country during the period in question. To be sure, the flax grown has not been of the kind that yields the finer fibres, but the experiments of the Department of Agriculture have shown that the variety of flax producing the finer fibres can be successfully produced over the whole flax producing area mentioned above. So far, then, as purely agricultural conditions

are concerned, the United States has many and important advantages over other countries how producing flax for fibre. It would seem that all that is needed to introduce the cultivation of flax into this country on an extensive scale is the providing of a market for the fibre.

This last leads, naturally, to certain considerations in manufacturing in our country that favor flax culture and the linen and lace industries. Southern competition in the coarser cottons has already been hinted at. It seems inevitable that the manufacture of coarser cottons will be gradually transferred to the South. Indeed, if this movement towards the South continues at the increased pace of the last ten years, the South will be making the larger part of the coarser cottons manufactured in this country. The New England cotton manufacturers must face this fact squarely, and with the same indomitable courage and enterprise with which they have faced the many obstacles of the past. New England has led the country, not only in letters and in the fine arts, but in industrial and commercial affairs as well. She has been the first to feel the currents of new industrial and commercial needs, and the first to grasp the conditions necessary to meet these new and growing needs of our country.

Attention has been called earlier in this paper to the very large consumption of linen goods in the United States, amounting at the present time to nearly 50,000,000 of dollars annually. The fact has been pointed out also that cotton can never wholly take the place of linen goods; that instead the consumption of linen goods in proportion to cotton goods in civilized countries is steadily increasing. With these facts before them the New England manufacturers will not long delay making a thorough experiment in the manufacture of linen fabrics. Many of the conditions favoring the agricultural side of this industry also favor the manufacturing phases. Abandoned farms have been referred to. Many of you know to your sorrow also of abandoned and partially abandoned mills and manufacturing plants. One of your problems is how to utilize this abandoned property with

the valuable water power so often connected with it. Certainly any enterprise that promises within the range of probability to occupy this abandoned property and make it productive to the fullest limit is worthy of your earnest consideration, especially since the amount of this property will be more rather than less in the future, if some industry to take the place of the coarser cottons is not developed. Another favorable condition is that native Yankee enterprise referred to in connection with the agricultural features. You are aware, of course, that the cotton industry of the world owes more to the inventive genius and mechanical skill of Americans than to all other causes contributing to its progress. It is not necessary to enumerate to you the revolutionary inventions and methods introduced into this industry by Americans. Such an enumeration would be practically a catalogue of all the machinery of modern cotton manufacturing. The manufacture of linens has not had the benefit of this inventive genius because the industry has never flourished in this country to a large extent outside the homes. As a consequence the mechanical processes are admitedly crude and clumsy. To be sure, the machinery has come to be comparatively elaborate but it is not nearly so well adapted to the ends for which it is used as our cotton machinery. Without doubt, if the manufacture of linen should be introduced into this country on a large scale we would ere long outstrip the countries now engaged in the industry in the development of machinery. There is such large room for improvement in the mechanical processes that our manufacturers would thereby secure a very great advantage over all competitors. A third favorable condition remains to be noted.

The manufacture of the linen fabrics requires a higher degree of skill than the handling of cotton fibre. Wherever highly skilled labor enters into any industry the United States has an advantage over foreign competitors. You have found in this matter that the best is the cheapest; that no labor is so dear as the so-called cheap labor of foreign countries. Having at your doors an adequate supply of skilled labor is an important consideration in your favor. A final condition worthy of note which

would be established by the introduction of this industry into New England is the building up of a home market for all kinds of manufactured goods. If the abandoned farms of New England could be re-peopled by the growers of flax, New England by this intense form of farming could support a rural population many times as great as she has ever supported. We have become too easily reconciled to the movement of our rural population into the cities and into the more fertile plains of the middle West. We have come to regard this as an unavoidable necessity. We have reasoned about it a great deal and have concluded that New England is destined to be more and more a manufacturing centre and less and less devoted to large agricultural activity. But we shall one day have to face the problem of the older civilized countries of the world,—the problem of how to make every foot of our territory productive in some way. No greater folly is possible than that the good acres of New England soil must remain untilled with our population increasing more rapidly by birth and immigration than ever before within its history. It *is* impossible for New England farmers to compete with the middle West in growing cereals or with California in growing fruits. It is easily possible, however, for her to return to her early agricultural activities if she can introduce this flax industry or some other specialty for which her climate and soil are adapted and especially which might be directly related to her manufacturing industries as is the raising of flax for fibre.

Some recommendations may not be out of place in this paper about how to proceed experimentally looking towards the introduction of this industry. We cannot do better at this point than to quote from Mr. CHAS. RICHARDS DODGE'S Ninth Report on Fibre Investigations recently issued by the United States Department of Agriculture.

"Flax culture for fibre cannot be established in the United States on the lines of practice in foreign countries. As the case stands the farmer is hardly in position to grow flax save in an experimental way until he is sure of a market and the manufacturer—that is the spinner—is not in a position to make offers of

purchase or to name price because he is not sure that the farmer can grow flax of the proper standard or that he can afford to purchase at any price for his particular manufacturing such flax as the farmer may produce. This simply means that what isolated farmers cannot accomplish alone must be accomplished by the establishment of little local industries. To borrow a foreign term, the future flax industry must be cummunal; that is to say, capital must establish suitable mills in localities where flax may be profitably grown, farmers of the neighborhood agreeing to produce five, ten or twenty acres of straw each under the direction if need be of the managers of the mills to insure the growth of a quality that will give the proper standard of fibre. In Canada and in northern Michigan, where the industry is successful on a small scale, the practice is to sell the seed to the farmers at the mills at a fixed price per bushel, the farmer agreeing to sow a certain number of acres to flax the straw from which the managers of such mills agree to take at a fixed price per ton."

These recommendations of Mr. DODGE are of a very general nature but indicate with sufficient clearness the fundamental necessities of the case.

After a careful examination of all that has been written upon the subject and as a result of personal investigations covering the period from my visit to Ireland and the continent for special investigation in 1851 to the present time, I venture the following practical suggestions about how to proceed in the establishment of the flax and linen industries in this country. The United States has been very generous for nearly forty years in appropriations for gathering information and for the purposes of extended scientific experimentation in this industry, and especially so during the last decade of this period. Mr. CHAS. RICHARDS DODGE has been a special agent in fibre investigations of the United States Department of Agriculture during this latter period. He has covered the ground of flax culture and linen manufacturing in this country and abroad very thoroughly. His reports, nine in number, contain all the general information necessary for the making of a beginning of the industry in this

country and also recommendations of the highest value. What is needed first is a capable and progressive committee from such a representative body of manufacturers as this to co-operate with Mr. DODGE and the United States Department of Agriculture in carrying their recommendations into effect. Abundant information of the most detailed and reliable kind is at hand illustrating every phase of the industry, from the selection and preparation of soils up through every step of the agricultural features, as well as the processes of manufacturing, to the finding of the consumers for the finished manufactured product.

A committee, representing a body of capitalists of adequate resources, such, for example, as our New England Association, is an absolute prerequisite as a preliminary step. Such a committee, with a paid secretary who should devote his whole time to the business, should address itself at once to the following tasks. First, they should acquire by lease or otherwise a plant sufficiently commodious for adequate experimentation, in a locality where a score or two of farmers are willing to grow a definite number of acres of flax each. The committee should have power to import the very latest and best machinery, both for scutch mills and for the manufacture of linen goods — in short, should be empowered to do in New England what has already been so successfully done in Canada and in Michigan. When such a committee is ready to proceed, backed by such an organization and by the representatives in Congress of such a constituency as New England boasts, there is no doubt that adequate protection in the form of a tariff on importations could be secured. Even without protection a beginning *can* be made, in the opinion of all experts on the question. But with protection, by making use of the abundant information at hand, there is not the slightest risk. Indeed, there is every reason to believe that financial success is certain from the beginning. It is equally certain that the growth of the industry will be steady and substantial from the first, since every possibility of failure has been anticipated by previous experiment. Once sure of their ground through such an initial step, the committee should

be authorized to acquire large tracts of suitable lands in the vicinity of present plants and water privileges, to which the industry may be extended as rapidly as is expedient, the distinct aim all the time being to supercede the making of the coarser cottons by the making of linen fabrics. As fast as the space now occupied by coarser cotton machinery can be utilized by linen machinery, the cotton machinery should be transferred to the South, where mills should be established or acquired by the association. This double plan will secure to New England the great and remunerative linen industry to take the place of the coarser cotton manufacturing that you are bound to lose in the end, anyway, and will enable New England capital and brains to compete on equal terms on its own ground with the South, that is, taking the coarser cottons from us on account, chiefly, of certain distinct local advantages, as we believe.

This industry is as certain to become one of the chief industries of the United States as that our country is certain to continue to lead the world in manufacturing enterprise and progress. It must be a matter of constant wonder to every serious investigator that such an enormous industry, for the lack of which we are paying an annual tribute of 50,000,000 of dollars to European countries, an industry demonstrated by the United States Government and and other experts over and over again during nearly half a century to be easily within our reach, should still remain simply a possibility, when all that is needed to secure it is that Yankee spirit of enterprise and eagerness for accomplishing great things that have made our country what it is.

The introduction of this industry cannot be long delayed. If New England is first in the field, as she has been so often in the past, she will reap the chief advantages and benefits. Will not this Association choose a capable committee at this time to give this question the earnest consideration it deserves? a committee empowered to employ a secretary and to seek governmental and other assistance in taking the initial steps in the enterprise.

Mr. T. E. CHAPPELL. I will say that if anyone wishes to ask any questions with regard to this matter, covering any points in the paper or any point not touched upon by the paper, we shall be glad to spend a few minutes in answering, as far as we are able, such questions.

Col. SAMUEL WEBBER. Mr. President and gentlemen, I have read my old friend, Mr. DAVIS', paper with a great deal of interest, but it has occurred to me that there are still one or two other points to be mentioned besides those which he has touched upon. I will state, in the first place, that it is a matter to which I have given a great deal of attention for a great many years. As you will notice, in the paper which I shall have the honor to present to you by and by, in the early years of the forties, from 1840 to 1845, I was engaged at the Merrimac Print Works in Lowell in performing a series of experiments on engraving copper rollers by electricity. While waiting for the galvanic batteries to work, with their slow action, I had a great deal of spare time, and I occupied a portion of that by translating from the French a paper on flax culture and manufacture, published in one of the bulletins of the *Societe Industrielle de Mulhouse*, and which was then, and propably is now, in the library of the Merrimac Company. What became of the translation I do not know, but the original French volume is undoubtedly there.

When I went to Europe in 1850 I had two main points given me to investigate, one was the worsted manufacture and the other that of linen. I looked up the worsted manufacture, found that it was very practicable for this country, and sent out a set of worsted machinery, the result of which may now be seen in the lower Pacific Mills at Lawrence. The flax machinery I found to be of similar character, but I found that although the mechanical part of it could be easily adopted in this country, there was a point to be gotten at before the flax was in order to manufacture. At the time I went over to Europe what was known as the "Chevalier Claussen flax cotton" discovery was in full blast, and I looked that thing up very thoroughly. I

went to England, Scotland and Belgium and examined the matter and I found that flax cotton was neither more nor less than tow, and when you got it you could make nothing else of it, no fine cloth of it. The thing dropped of itself after a while and the whole question was given up completely. I also looked the fine thread matter up, beginning at the Marshall Spinning Mills, at Leeds, then looking at the Scotch Spinning Mills, and going over into Belgium where flax was grown, and I found as the result of all these examinations, that flax, as grown in this country for seed, was utterly unavailable for the manufacture of any linen goods except the very coarsest, and wasn't used at all for that purpose. I found that enough of the flax would be allowed to go to seed to give seed for the next year's crop, but the flax to be manufactured into linen was carefuly pulled up long before it was ripe. It was all kept in uniform bundles and those bundles were put in the shallow water of ponds or streams. There were kept there for a certain length of time the root end down, and then turned over by hand and put in a certain time tip end down, the fibers always kept perfectly straight. The matter involved a good deal of manual labor, usually done in Belgium and in the north of Ireland, by women and children. After the flax was properly retted in this green state and brought to a suitable condition, it was taken out of the water, still keeping the bundles together, the roots chopped off, then scutched by a wooden sword to break up the stalk and then hackled or combed by hand, and from that point after it was combed out in these long bundles of fibre, the process throughout with the yarn was almost identical with what we have all seen in long wool combing. Wool combing by machinery was then just coming into practice. After the combing, which was done by hand as I have said, and the hackling of the flax, then the processes were almost identical in all their appearances with that of worsted manufacture, except that the distance apart for the rolls was longer, to provide for the longer fibre as it came from the stalk. It must be borne in mind that the fibre of flax as it comes from the stalk is not the integral fibre. The fibre as it

comes from the stalk is a lot of fine fibers cemented together by a vegetable mucilage or glue which has got to be dissolved before they can get it into linen yarn. So after this has all been drawn out into a long state through the preliminary machinery, when it comes to the spinning frame, it runs first through boiling water, as I saw it at the Marshall Mills, and all I saw of the drawing rolls were as big again as any cotton spinning. They were all made of brass. They run over a copper trough full of water which was heated by a steam pipe, a little passing in all the time at each end, and the fibres went down into this water under a brass rod. This boiling water softened the mucilage or glue and enabled it to be drawn down into fine yarn.

When I came back home, I found that the Hon. DAVID A. WELLS had been investigating the matter of preparing flax as grown in this country into a fibre for spinning, and he was then having experiments made at Smith & Dove's mill at North Andover. I went into the matter with him, and gave him all the information I had gotten about it, and we made a good many experiments and we succeeded in making a very coarse yarn, making it into coarse coth, from the fibre treated in that way. When we started the mills at Indian Orchard, the idea was after the manufacture of cotton was started to take up flax manufacture. We were obliged to start the cotton mill first, because the whole property was mortgaged to the Lowell Machine Shop for machinery, and we couldn't start the mill until we got that machinery and put it into operation. Meanwhile experiments were carried on with flax procured from the west, but out of the car load of flax sent from the west, as it came to us, flax which had been raised for seed, but a very small proportion was found fit to do anything with. It was tumbled up in the car and when we came to get it out and attempted to work it, there was but little of it we could get anything more than tow out of, and the thing was finally dropped in that way. A preliminary matter, as it seems to me, in the manufacture of linen in this country is to procure a whole series of samples of flax with their cost delivered in this country and their cost abroad, and to distribute

them in agricultural districts, giving them the information that this flax must not be allowed to ripen, that a certain portion of it may be ripened for seed, but that the most of it must be pulled green, and ask the farmers after looking at these samples to see if they can provide this staple in this country, and in what quantity and at what cost. If a sufficient amount of flax can be procured out of the thousands of tons that are now thrown away or burned up as useless after it is raised for seed, if that can be changed and a certain portion be taken while it is still green and prepared for spinning, there is not the slightest trouble in any mill putting in the machinery and mechanically it can be handled just as well as worsted or cotton is today. It seems to me that the first move this Association ought to make is to procure these samples of flax and distribute them thoroughly in the agricultural districts, and see if the raw material can be procured in a proper state for manufacture. Some twenty odd years ago, I had occasion while measuring power to make a number of measurements at the flax mills of Barbour Brothers at Paterson, N. J. There again, I found the machinery exactly what I had seen in England twenty years before, and that they had to depend almost entirely on imported flax, if not entirely. They were not able to get home grown flax of proper character to spin into linen thread. And adding these remarks to what Mr. DAVIS has said, I leave the matter in that way with the Association.

Mr. EDWARD ATKINSON. This seems to be so far the old man's day. [Laughter.] I believe my two seniors have already spoken, and I am inclined to think that I am number three among you.

This is a very interesting subject and one that having been opened, ought rightly to be very fully covered. I will take two or three minutes for my part. It must be remarked in the first place that flax is no longer considered a suitable material for clothing except for outer garments. It is going out. Cotton and wool are being substituted even in Italy on account of more

wholesome conditions. The only suitable use of flax in clothing is for outer garments, not for any other garments and not for sheets. All modern hygienic authorities condemn flax, as conveying off the heat of the human body and leading to dangerous conditions. In the second place you will remember that cotton is the only fibre that nature gives us in a condition to be spun without any other preparation than separation from the seed. Every other vegetable fibre must either be scoured or separated from other growth with which it is surrounded. Wool must be freed from its own grease and then greased with an artificial grease. Flax, hemp, ramie and all other fibers that are contained in the stalks of plants must be freed from extraneous substance before they can be made use of.

In respect to flax there is as yet no substitute for a process which is called "retting", that means rotting. The fibre is mainly carbonaceous material drawn from the air. The surrounding substance is a partly nitrogenous material and partly a starchy material, which must be rotted off. The cultivation and preparation of flax requires a very much greater number of hands in the getting of the flax ready for the machine than it does to carry it through the machine. That preparation is a laborious, filthy, unwholesome business. So long as we can leave it to foreign pauper labor to do, we cannot afford to put our population on this work; all can do better for themselves. You will not induce intelligent farmers to undertake to pull green flax by hand, then rot it and to do the unwholesome work which is required to prepare lined flax in order to supply the mills of this country. We can import flax by the exchange of our wheat or cotton for it, not our money. By exporting our products in which the wages are high and the cost is low we can secure all the flax from Ireland, from Belgium, from Italy, from Russia and other countries where wages are very low and the people are obliged to undertake this work in order to exist.

In this respect the flax manufacture corresponds somewhat to tin plates. The tin plate manufacture has been transferred almost bodily to this country. Why? Down to a given period

the dipping of the black plate in oil, acid and melted tin was a nasty, filthy, unwholesome process conducted under bad conditions of life, unfit to be introducted into this country. By the substitution of mechanism for the larger part of the manual practice which had developed an inherited aptitude in Wales, tin plate making has been transferred to this country. It is through the competition of American machinery and American intelligent processes with the old hand methods of Wales, that the tin plate manufacture has been established at high wages and low cost.

Now all these fibres, flax, ramie and the rest of them, are waiting for the inventor. Ever so many fortunes have been lost in attempts to decorticate these stalks, and more probably will be; but the right man will by and by come, and all this difficulty in the preparation of flax will be done away with; then will be time enough for us to go into its preparation. The right way to establish flax manufacture in this country is to remove the obstructions to the import of the crude material which we cannot afford to make for ourselves; then we will have a fair opportunity to devote machinery to the manufacture of flax into fibres for which it is suited. These fibres are, of course, very numerous, but flax is not a substitute for cotton and never will be. Cotton and wool will hold their places as the clothing of the human body, with flax as a luxury for outside wear in hot climates. As Mr. WEBBER has said, the production of flax seed in the West has been one of the variations from the "all wheat" system by which the West is growing rich. It corresponds to what I told the southerners so many years ago, that if we had had a cotton plant producing no fibre and nothing but seed, it would long since have been one of our most valuable products. Well, flax produces both fibre and seed, but for seed alone it is one of our most valuable products. The last time I was down South I told my southern friends that if we had the conditions of soil and climate of the Piedmont district, where they are putting up so many cotton mills, we wouldn't spend our time and capital in that kind of undertaking;

but if we possessed those conditions in the North, where nothing but a hairless sheep that would furnish meat and fertilize the the earth could be raised, we would have devoted our energies to the production of mutton and the doubling of the crop of cotton on those fields. With proper attention the Upland cotton planters can produce the wool that this country needs with an excess for import, by working sheep simply as auxiliaries in the varied agriculture that is now coming into the South.

In this matter of flax we have therefore to bear in mind two things. *First*, not to make an effort to substitute flax for cotton. Each has its place. I looked into that when friend WEBBER did, years ago, when the "flax cotton" idea prevailed. *Second*, we must not attempt to do an arduous, filthy, unwholesome kind of hand work, or try even to protect ourselves against that kind of pauper labor by any tariff obstruction. Let these crude products in free, invite them, and then start your skilled labor on the mechanism of the manufacture.

If you begin in any other way you will probably have the experience which one of my old friends had when he built that great linen mill of granite in order to go into the manufacture of flax and hemp. On the corner of the mill he inscribed this motto: "All things have been others; all things will be others." Within less than two years the mill was in the hands of the mortgagees and the builder was a bankrupt.

These arts must grow, they cannot be established on a large scale by men without experience. I have no faith in any plan for substituting manufacturers of flax for cotton in New England, nor have I any fear that the lead of New England in the cotton manufacture is lost or in any considerable measure impaired.

Mr. ROBERT MCARTHUR. I noticed that Mr. ATKINSON in his remarks spoke, incidentally, about tin plate. I have often been surprised at the great progress in the tin plate industry in this country. I did not know until today the reason of it. I had often been led to believe that the protection which had

been given to that industry had something to do with it. [Applause.]

Mr. EDWARD ATKINSON. I am glad to have disabused your mind, in part, of that idea. [Laughter.]

The PRESIDENT. I have two or three minutes before the close of the session; I think we had better close by half past twelve. Mr. CHAPPELL went over the ground quite thoroughly with Mr. DAVIS in regard to possible questions that might be raised, and he tells me that there are some replies that he is prepared to make, and I think we would like to have Mr. CHAPPELL speak again to us on this point.

Mr. T. E. CHAPPELL. I think there are some important questions that can be answered in two or three sentences. Of course you understand this paper was not intended to cover the details of manufacture. That has been covered so thoroughly by experts that all we felt competent to do was to refer you to the reports containing the findings of the experts, both in our country and abroad. One statement made was that we cannot get both fibre and seed. Now that is generally believed by American farmers but it is not true. In Belgium both fibre and seed are harvested and harvested in good condition. For a time it was impossible to get both fibre and seed, but that is done now regularly. It is done in Canada and Michigan and at the experiment stations at the present time.

Mr. EDWARD ATKINSON. You cannot get the fine fibre which is necessary to mannfacture into goods, I believe, except from the green flax. They are now beginning to get a fibre which is useful from flax which has matured, by care in harvesting and in its treatment, but it does not serve the same purpose. that the flax serves which comes from the green plant. Mr WEBBER will confirm, whether I am right in that or not.

Mr. T. E. CHAPPELL. Well, of course I am not an expert in

the business; we have been compelled to follow the experiments of the Department of Agriculture a great deal. They inform us without any qualifications whatever that, with the present processes of taking the seed from the plant—not by any old process of thrashing — the finer fibre is obtained — the very finest fibre. Of course I do not know whether that is true or not. I simply have to rely upon that report, and I would like to refer anyone interested to those reports of Mr. DODGE, that will be furnished free to any member of the Association on application, and they are full of the meat of this subject.

Now the last speaker, I think, referred to the fact that linen goods are considered unhygienic. I am greatly surprised at that; greatly. What material are they using in hospitals now in the dressing of wounds? Is it not linen? And if it is used in the dressing of wounds and in surgical operations it certainly cannot be unhygienic. We have been led to believe, in the reports of Mr. DODGE, that the contrary is true, that underclothing, clothing worn next to the skin, is very much better made of linen than of cotton. But of course this paper does not aim to have linens take the place of cottons; not at all. There need be no conflict between the use of the two fabrics, between goods made from the two fabrics, in that respect. Cotton certainly, and wool will retain their place. It is only that linen has its place also.

Now the first speaker, I think it was, referred to what should be done at the present moment. That ground has been covered so carefully by Mr. DAVIS that I cannot allow that criticism to pass without saying his word, which he has posted me to say in advance, and that is this. This experimentation which the first speaker suggested, of collecting samples and distributing to the farmers and finding whether they can produce these qualities, has been done over and over again for fifteen years. It is not necessary to make that experimentation, it has been so thoroughly made by the United States Department of Agriculture. As is said in the paper, in every State in the northern half of the United States, these samples have been sent, samples

of seed, experiments have been made, and that experimentation is not necessary. So far as I have been able to glean the facts from these reports of the United States Department of Agriculture, no experimentation is required on your part, because every detail of the agricultural features and the mechanical features has been covered — the agricultural features by the Department of Agriculture in the States mentioned, and the mechanical features in the special mills established in Michigan and Canada. Mr. DAVIS therefore pleads for a committee that would undertake to bring together for the use of this Association this information that has been gathered by experts already, and upon which, of course, the introduction of the industry must depend.

The PRESIDENT. I am very sure it would be very agreeable to us all to continue this subject, and we are very much indebted to Mr. CHAPPELL for the kindness that he has shown in this matter. When the Board of Government, through the Secretary, learned that Mr. DAVIS would be willing to place in shape to be read here the result of some of his investigations in regard to flax culture, we learned at the same time his physical inability to do it, and the Secretary arranged with Mr. CHAPPELL, his pastor, to act as amanuensis for Mr. DAVIS, and, as he stated in one of his letters, he personally became very much interested in the subject from following along in Mr. DAVIS' line of thought.

Mr. EDWARD ATKINSON. I think we ought to be very grateful to Mr. DAVIS for this paper. The subject is one of supreme importance and I would move that the subject be referred to the Board of Government to take such action in regard to appointing a committee as may be suitable in the premises. There is a great deal of information to be obtained; it has not yet been gathered, and how to get it is a factor that enters into the question. It seems to me that we are warranted in that more than anything else.

Mr. ATKINSON'S motion was seconded by Mr. WALTER PARKER.

The PRESIDENT. Just how would you word the motion.

Mr. EDWARD ATKINSON. Simply that the formation of a committee, and any other measures that might rightly be taken to procure further information and develop this subject, be referred to the Board of Government with power to take action in the premises.

The motion was put and carried.

[Adjourned.]

SECOND SESSION.

CHIPMAN HALL, WEDNESDAY, APRIL 27, 1898.

The meeting was called to order at 2 P. M., President EATON in the chair.

The PRESIDENT. The first paper on our programme for this afternoon is "The New Prior Roller Cotton Gin", by Mr. THOMAS W. PRIOR of Philadelphia.

THE NEW PRIOR ROLLER GIN.

THOMAS W. PRIOR, Philadelphia, Pa.

This roller gin promises to mark an era in the treatment of cotton fibres and if it performs even a portion of what the inventor claims for it, threatens the existence of the present saw gins. Mr. MATTHEW PRIOR, of Watertown, Mass., is the inventor of the new gin, and after its inventor, it is called the "Prior Gin".

The problem of treating the cotton fresh from the field, if we are to judge from the paramount use of the staple destroying

saw gins, has never been correctly solved; for the ginner has been practically forced, by the failure of other processes, to use a method of ginning which robs the staple of half its life before it reaches the spinner, and no one better than the spindle operative can appreciate the deadly action of the saw gin upon the sensitive cotton fibres. Mr. EDWARD ATKINSON, in a recently delivered address in Atlanta, stated that $30,000,000 is each year wasted by not using skill and intelligence in the handling of our cotton crop. He says, "If the bad ginning, and barbarous treatment of cotton from the time it leaves the field until it reaches the factory, could be stopped, and better methods substituted, it would result in a saving to the cotton grower of from $2 to $4 per bale, or a gross gain each year of between $20,000,000 and $40,000,000.

Not only does the saw gin destroy much of the life of the cotton, but with its "motes" and "picker waste", loses to the planter and mill owner fully 6 per cent. of every bale of cotton ginned. The Prior gin demonstrates in actual use that the average of twenty or more pounds lost in picker waste on each bale that comes from the saw gins, to say nothing of the loss on motes, of which there is none, is reduced to the sand and leaf particles, or not more than two pounds per bale, the gin absolutely dispensing with the "neps" or doubled pieces of cotton pulled through the breasts of the saw gin, which, never straightened, are thrown off in the spinning, or lumping, create a perceptible diminution in the quantity of threads produced. The saving on motes and picker waste alone, means on the figures of last season's complete crop of 9,000,000 bales at 6 cents per pound (the minimum figure of sale), a grand total of $10,800,000.

The new gin preserves absolutely the natural length of the staple, straightening the fibre in the ginning and increasing the value of the cotton in the open market, as against the same cotton ginned by the saw gin, three-fourths of a cent per pound, or a total on the crop of 1897 of $33,750,000.

The field gleanings, shelly stock, and immature cotton, frost

nipped in the bud, impossible of handling by the saw gins, which cut the shells and deteriorate the output, is ginned perfectly by this new gin, the tenacity of the roll enabling it to handle with equal facility the longest and shortest staple grown.

A special feature of the new gin is its perfect handling of the "grabotts", or oil mill screenings; of a sample recently sent from Mr. JOSEPH W. ALLISON, of the National Cotton Oil Co., from Houston, Tex., the result showed 33⅓ per cent. pure cotton recovered, 40 per cent. of seed, in shape for re-screening, and 26⅔ per cent. floor and general trash waste.

Mr. ATKINSON, who has investigated the merits of the new gin, says that "as a 'trash' handler I have never seen a machine to equal it".

Many roller gins have been invented with intent to displace the saw gins so generally in use and to overcome their serious injury to the staple, but none up to the present time has been put before the cotton grower that will handle the long and short staple cotton equally well, or that has the capacity to compete with the swifter saw gin, whose teeth take each its continual share of fibre, while the best of roller gins are magnificent examples of "lost motion", relying only on the friction of the swiftly moving roller to pull the staple through. In fact, the main defect in roller gins lies in that vital point, the roll.

Metal rolls have been tried, but the metal teeth succumb to foreign matter in the cotton and the gin becomes valueless. Canvas and rubber rolls have equally demonstrated their unfitness by the smoothness which quickly destroys the roll's grip on the fiber, and the walrus hide roll also acquires an eventual smoothness that calls for constant "roughing up" to keep them at all serviceable.

The basic feature of the new gin is, of course, the patented roll, which is so tenacious in its grip that it removes all the cotton from the seed, preventing the percentage of loss on motes and picker waste and absolutely perserving the length of fibre, presents the cotton in perfect shape for the spinner.

The roll is composed of horse hair imbedded in rubber with

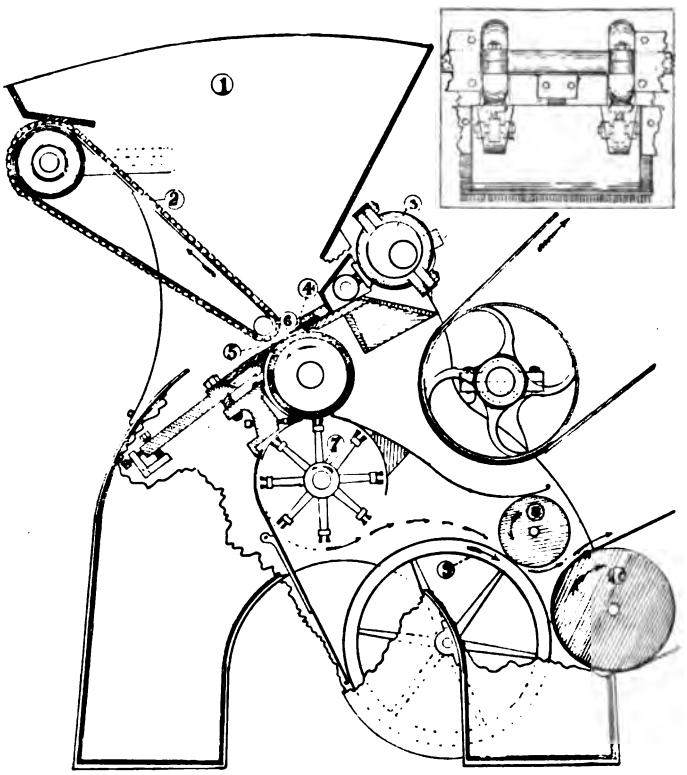
the ends of the hairs pointing outward, each hair constituting an indestructable tooth; the roll surface presenting about 3,360 of these teeth to the square inch, which, projecting the infinitesimal part of an inch above the rubber, from a surface so tenacious that it has fully as strong a grip on the cotton staple as the saws of the saw gin without their fatal effect on the fibre.

The vulcanized rubber and horse hair teeth combined wear as leather wears around a metal nail in the sole of a shoe; for, as the nail always projects slightly as the leather wears around it, so these teeth in use always remain a trifle above the rubber, sufficiently to keep a perfect grip upon the cotton. Actual use has demonstrated that the roll will stand the hardest kind of wear for three or four seasons before renewing.

One great advantage of the new gin is its absolute immunity from fire; nails, flint, and metals of all sorts may pass through the gin without detriment of any kind, and are promptly "kicked out" without deteriorating the cotton, this feature being a valuable one alone, if we are to judge from a letter to the *Manufacturers' Record* of Baltimore, from Mr. A. OLSEN, of Elliott, Miss., who writes: "After starting up my plant last fall, I had only ginned 330 bales when my gin caught fire on October 29th, and burned down, with a complete loss of everything except forty round bales, and the engine and boiler and press, which were standing on a brick foundation".

Probably the most severe test that could be given the new gin was the perfect re-ginning a few weeks since of 50 bales of Peruvian cotton so badly ginned as to be unmarketable and which the best saw gins had signally failed to re-gin.

The mill owners are ready to adopt any method tending to better the quality of the cotton, while the grower is anxious to increase the value of his staple; and a gin that not only preserves the length of fibre, but will handle the same amount of cotton as the saw gins, and reduce the general waste to a mimimum, will ultimately be a portion of the equipment of every cotton plant and ginnery in the country.



1. Hopper.
2. Moving Feed Apron.
3. Eccentrics Operating Combs.
4. Comb Points.
5. Knife Blade.
6. Horse Hair and Rubber Roll.
7. Revolving Fan.
8. Upper Compressing Roll.
9. Revolving Screen.
10. Lower Compressing Roll, with moving apron to press.

In the ginning, the cotton is thrown into the hopper (Fig. 1) upon the moving feed apron (Fig. 2), and directly upon an exposed part of the roll (Fig. 6), which seizes the fibre, carrying it toward the presser blade (Fig. 5), where it is met by a plunging comb (Fig. 4), which pushes back the seed and foreign particles, allowing the pure cotton to pass underneath the presser blade (Fig. 5), while the seed and other substances are expelled from the machine over the presser blade.

The cotton is then carried around by the roll until it meets the underneath brush (Fig. 7), which removes it from the roll, allowing it to fall upon the moving screen (Fig. 9), which permits the sand and leaf particles to sift through, the cotton then being carried between the compressing rolls (Figs. 8 and 10) in a bat on a movable apron to the press; the new gin requiring but one-third the horse power requisite in a saw gin of the same capacity.

Where the saw gin of the same capacity will take four or four and a half or five horse power, this gin can be run for one and a half. I would also like to say that the machine is on exhibition at 161 Pearl Street, and will be during the time of the meeting, and we would be very glad to have anybody interested call there and watch the machine in active operation. I would also like to ask if there is anyone present interested in the making of cotton flannels? If so, I should like to talk with them in that connection, for I fancy this will make the best thing that there is for that particular purpose.

The PRESIDENT. Do you wish to call special attention to the samples?

Mr. THOMAS W. PRIOR. Yes, I want to call special attention to these various samples, to the sample of oil mill screennings, which I think you will find to be a most excellent thing. I should be very glad to answer any questions.

The PRESIDENT. Does any member of the Association wish to ask Mr. PRIOR any questions in regard to his paper, or to make any remarks in regard to it?

Mr. STEPHEN A. KNIGHT. I would like to inquire in regard to the comparative expense between this and the saw gin.

Mr. THOMAS W. PRIOR. Well, we figure it about the same capacity and the same expense. They charge for so much a saw, and we propose charging for the same capacity the same figure. The average price I believe is about five dollars a saw.

Mr. EDWARD ATKINSON. The roller gin which has been presented to you is one of several of which I have kept track for the last thirty years. It has seemed to me to contain the germ of success, if not complete. I am not, as you know, a mechanic; I am theorist. The theory of the roller gin must prevail. The saw gin must be invented out of existence. Who will do it remains to be seen. The improvement of cotton is now in the air. I have lately been speaking in Atlanta on the development of southern industry. I there told them that the inducements which they offered to northern capitalists to come South for the manufacture of cotton, of long hours, low wages and child labor, gave the most complete evidence that they had neglected the advice which I gave them in 1880 and 1881 and since, to develop the lesser industries of the South, from which high wages, short hours and ample product, on moderate capital, could be attained. I then gave them this comparison; these were my words in 1880 and 1881. What course have you taken? Counseling you to move slowly, you have not moved slowly. You have gone through with a boom on iron furnaces and that has burst; now you are on a boom of building isolated cotton mills, of insufficient size for the ablest management, and that boom will burst. You are laying a foundation for a large crop of experience, and the crop of experience will be reaped by one set of men, and another set of men will get the mills. In

the interval, the competition is adverse to all parties. The question is a great deal deeper than North and South. It is how to manage an excess of product beyond the consumption of our own people, without ability to develop the outside market, in time to save us all from loss.

Now, I said, what have you neglected? Since 1880 you have erected two and three-quarter millions of spindles south of the Potomac. You claim to have expended $80,000,000, mainly of southern capital. If you have expended that amount of money they have cost double what they ought. At $15 a spindle, which would be the outside for the investment in the types of factory that have been built in that section, they are worth to-day $40,000,000. Now let us make up your profit and loss account. Suppose, for a miracle, that you did make 20 per cent. this year on $40,000,000, which you will not make, and you pass to the credit of profit and loss account $8,000,000. Now what is your debit? You will make in the southern land this year over 10,000,000 bales of cotton. You will have lost two dollars a bale for bad baling. That is no longer a theory, that is a fact, well proved. There is $20,000,000 You will lose by bad ginning, by handling, pickage, stealage, high cost of insurance, high freights, and all the other evils to which you subject your great crop, two dollars a bale more at the minimum, and that is $20,000,000. Profit and loss account: credit, $8,000,000 possible profit on cotton manufacturing; debit, $40,000,000 for neglect of the most important department of cotton manufacturing that there is in existence, which of necessity must be conducted here in the southern land. And under these conditions you expect to compete with us! It is a little hard for all of us at the present time, but you will not succeed in removing the cotton manufactory from New England. The invention of the cylinder bale has moved all the New England mills one-half nearer to the cotton field than they were before, or more. There is now a second cylinder bale in the market, and there will presently be a third, of which you have not yet heard.

And this leads up to the roller gin. You are aware that for a long time I have urged here and at the South improvement in the handling of cotton, and now it is coming to fruition. You are calling more and more for the medium long cottons, and you are importing the Egyptian. Thirty years ago, more or less, I imported Egyptian seed, thinking that that was the way to get long cottons. I sent it to Texas, and it was a complete success in the gardens of Galveston. From there it went to different points, and was finally dropped because there were no suitable gins to prepare it. Later, Mr. WENTWORTH of Cairo, southern Texas, had taken up Egyptian cotton, and he has raised Egyptian cotton successfully, a larger product per acre than he could get from the native cotton. He has also bred a hybrid. Through my instrumentality the experiment station of Texas imported a Dobson & Barlow knife roller gin, which by the experiment station was placed in the hands of Mr. WENTWORTH. He sent three bales of cotton to market. The price of the best cotton there and near that section is five cents a pound. This cotton brought, two bales of it eleven and a quarter, and one bale nine and a half, and that has set the Texas people afire. It has proved, as I told them twenty years ago, and as I told them now in Atlanta, that the section of country which thinks it owns a monopoly of any subject of production will surely come to grief. I have lately said to them, you have come to grief on cotton, and the schoolmaster of hard times is beneficially instructing you what to do. The greatest benefit to the State of Florida that ever occurred was the freezing of the orange trees. The people are now turning their attention to truck farming and gaining more than they ever did before. Virginia has been scathed by tobacco, and is now beginning to learn from her experience, and I told the southerners, "Your system of agriculture corresponds to what Governor WISE told you forty years ago: 'Your niggers skinned the land and your white men skinned the niggers, and now you are taking the consequences of your own doings'". The harder I hit them the better they liked it.

Now then, the next thing is this, that there are several (as many of you know, who are in the fine goods business) of the most intelligent planters down in the Mississippi bottoms, who have developed long staple green seed cottons, and who have been sending them to market as well prepared as they could be on a saw gin. But now my son, whom you all know, has placed in the Advance Gin and Mill Company at Vicksburg, two of the Dobson & Barlow roller gins, and cotton of the long green seed variety has been ginned on those gins and sent to market. You cannot tell much from small samples, but I have here samples of Mr. WENTWORTH'S Texas cotton, and I have samples of the cotton ginned at the Advance Gin and Mill Company on the saw gin and on the roller gin. The difference is perfectly plain in the bale, but not so plain in these samples. I have also here samples of cotton raised by Mr. GRIFFIN in Mississippi, the most perfect long staple green seed cotton that I have ever seen. Here is a small sample in the seed, and also pulled by hand. But now in the use of these two roller gins at Vicksburg, a discovery has been made. It is the saw gin that puts all that entrapped air into the cotton, which is taken out by the new roller gin, but which in the ordinary processes has to be compressed out in the compress. The cotton that comes from the roller gins comes in a compressed lap, and when laid lap by lap in the gin box in the square bale, and then covered and put under the ordinary screw press, the bale comes out as dense as the saw gin cotton comes out from the second compress. The saw gin is not only chargeable with the injury which it does to the staple in the process, but is chargeable with all the subsequent injury of trying to get the entrapped air out which that gin puts in.

I made this suggestion in Atlanta the other day, and I make it here now: I do not know that compressor rolls or condenser rolls have ever been applied to the cotton when it is delivered by saw gins, but it seems to me that I am giving away a pretty valuable idea when I suggest that the compression even of a saw gin cotton may be done away with, if a pair of condensing

rolls shall take the cotton when it is delivered from the gin and squeeze the air out of it before it goes into the bale box, and that you will then get a bale made in the lap, lap by lap, with the air squeezed all out, which, like the cotton that comes from these two roller gins, will then require only the ordinary screw press to make a bale at 23 to 25 pounds to the cubic foot. I rather think I am giving away a pretty good idea, but I am a theorist.

I have never seen an Egyptian ginning establishment. Some of you may have. But from my son's description it is as perfect as any of our picker buildings or cotton factories. The cotton is handled as carefully, sorted, ginned and baled as carefully in every respect, as we handle the cotton after we get it to our mills. And as I have said (and today with some chance of being listened to, for the South is alive to improvement), there is more profit in that department of cotton manufacture which consists in its preparation for the mill, waiting to be availed of to the tune of a waste of $40,000,000 on each year's crop, subject to being saved by attention to these particulars — a larger profit than there is or has been for a long time in converting that cotton into any kind of cotton fabrics in all the mills of this country.

Now I gave them another comparison. I said, "Gentlemen, I told you this in 1880, when one phrase which I used most unwittingly, without the slightest idea of its influence, has saved you last year $50,000,000 or $60,000,000. I happened to tell you in that address that had you been in possession of a cotton plant producing nothing but seed it would long before have been one of our most valuable crops", and on that phrase the cotton seed oil industry was built up. I hardly dared to take the influence which they attributed to that remark. "Now", I said, "I tell you again, gentlemen, if you mark my words, there is more profit waiting for you in the improvement of the cotton fibre from field to factory than will ever be made in the factory hereafter, South or North. You have made since 1880, 128,000,000 bales of cotton, and you have lost a cent a pound on

every bale of that by your own ignorance and incapacity in developing right methods of dealing with it from the field to the factory, and that comes to over $600,000,000 which you have lost by not paying the right attention to that branch of cotton manufacture which you must of necessity control and nobody else can. Now", said I, "the time has come when there could be brought about a co-operation between the northern manufacturer and the southern cotton grower, and I hope that those mills in which northern men are interested, and in those branch mills which are being established, the agents and owners will establish centres for the purchase of the seed cotton and deal with it from the seed to the loom with uniform intelligence, and then the establishment of southern branches of northern factories will set an example which will benefit the whole; because the more you improve that cotton, the more you bale it well, the more you reduce the freight, the less becomes the relative advantage by sections, if there is any advantage at all". I don" think myself there is much advantage. I doubt if there is any advantage in the South over the North, especially on fine work. The mills on the Piedmont plateau are already beginnning to find out that in competition for the long cotton, which they must have in working fine goods, New Bedford is nearer than they are, and I believe they are beginning to find out that they cannot make an artificial climate quite equal in relative humidity to that of the coast of New England.

Now, then, here are the various conditions: several persons have lost fortunes, especially in the Osgood gin, and yet the Osgood gin contained a germ which is liable to be developed. My friend comes here and presents to you another gin. As a trash cleaner I have never seen anything equal to it. I only judge by its results. What he does before your eyes is a very remarkable piece of work, and I advise you all to give it attention. And theoretically he is on the right track. So far as I have any knowledge of mechanics, he seems to me to have a germ somewhat corresponding to the germ which I thought I detected in the Osgood gin, which may lead to the true solution.

I am going to speak to the Arkwright Club in May and I am getting together material. The Arkwright Club and this club should now unite, or work together, to make that real co-operation between South and North which is necessary to the complete production or leading forth of the cotton fibre from the field to the factory and through the loom. I have dealt with this subject in this address which I made in Atlanta, to a considerable extent, and I think I will venture to present one of these copies to the Association, to the end that if the Executive Committee shall find in the tables of figures anything that they think will be interesting to the members in general, that they may make such digest or selection as an addition to what I now have to say, as will bring the subject before you as it lies in my own mind and has lain there for the last twenty-five or thirty years. These samples which I have are rather too small to pass around, but I will leave them with Mr. EATON, and those who feel specially interested can examine them. I have larger samples at the office, and I am bringing the matters together with a view to putting this subject very completely before the Arkwright Club at their May meeting.

Let me take the opportunity to add a word or two to the report in regard to the roller gin. The objection to roller ginning down to this time has been the expense in feeding and handling as compared with the saw gin. There is reason to believe, however, that in the present condition the roller gin may be set up in benches with a self-feed, so that it is even probable that the cost of putting our common green cotton seed cotton through the roller gin will not exceed that of putting it through the ordinary saw gin. If that is accomplished the whole work is done, because the only merit of the saw gin has been quantity rather than quality. The merit has been in the quantity; the injury has been in the quality. If we can bring the roller gin up in quantity, the quality will be so much better that the saw gin will die out.

Mr. MATTHEW PRIOR. I would just like to make the remark

here that this Prior gin now has a hopper which contains about two bushels of cotton; it can be dumped right in and the machine takes care of itself.

The PRESIDENT. I have listened to what Mr. ATKINSON has said with a great deal of interest, and I am sure that the Board of Government will be pleased to have the opportunity of using some of this matter that Mr. ATKINSON has presented. I will now ask Mr. BOURNE to read us his paper on "The Round Bale at the Mill".

THE ROUND BALE AT THE MILL.

STEPHEN N. BOURNE, Manchester, N. H.

The comprehensive and able manner in which the subject of the round bale was presented to this Association at its meeting last April by Mr. STEPHEN A. KNIGHT of Providence, and Mr. D. C. BALL of St. Louis, in their respective articles, "The Handling and Transportation of Cotton", and "The Round Bale and the New England Spinner", leaves little for me to add.

My own short experience with the round bale at the mill convinces me, nevertheless, that at last we are arriving at a solution of the problem of better baling, a problem which affects not only us as northern manufacturers, but also the southern planters, the transportation companies and the two or three other hands through which the cotton goes.

There are many features in the round bale which I have found desirable from my own mill point of view; there are other features which I have found undesirable. In as brief space as possible I will enumerate both, beginning with the unloading and storing at the mill.

There is no gainsaying the fact that in regard to the question of handling, the round bale takes the lead, provided, of course, that it does not exceed 300 pounds. A round bale of 200 to 300 pounds seems to me a convenient and feasible bale to handle, while one of 400 to 500 pounds would be harder and more awkward to manage than a square bale of the same weight. Round bales of the uniform weight of 250 pounds would carry with them many advantages not only at the mill, in the handling and storing, but also in the transportation to the mill.

In unloading and storing there is a slight saving over the

square bale, especially if the mill is short of storage room. No one will deny the fact that it takes as long to weigh a round bale of 150 pounds as it does a square bale of 500 pounds, but it seems to me that the extra time taken to weigh double the number of round bales is more than offset by the greater ease with which the lighter bales can be handled and piled in the storage room. If the mill has a storehouse large enough to receive the cotton without piling, then I cannot see that much would be saved either in time or labor at this particular stage of the cotton's journey.

Mr. BALL stated that "a material saving is affected in the opening room". I agree with Mr. BALL here, but I think that the cotton in laps is not in as good form for mixing. Right here I may state what has already been told this Association before, that the difficulty of what has been known as the "hard centre" has been overcome, but in so doing the lap has been condensed so hard that it has the appearance of being glazed, a feature which I consider objectionable.

One of the best features of the round bale is the neat and comparatively inexpensive covering which can be made for it. Instead of a covering of jute bagging of uncertain texture, this covering may be made of cotton, tube-shaped, with a gathering string at the each end, and may be taken off intact and used again. A very large percentage of these coverings could be sold for second-hand coverings, and the manufacturer could realize on good covers about the cost of the cotton in them. The poor covers would be worth about 60 per cent. of the price of cotton to tear up and put back into fibre. A cover, such as I have in mind, that could be used several times, and would cover a 250 pound bale, would weigh from 1½ to 2 pounds.

The binding wires I estimate at one-half pound per bale, making a total tare of 5 pounds on two round bales against a 23 pound tare on a 500 pound square bale. At the present prices which the manufacturer gets for his hoops and sacking, the advantage of the one over the other can be readily figured.

With such a cover as I have mentioned, there is a saving of

both time and labor in opening. Where it takes six men to open and pick the sacking of the old style bale, I estimate that four men can do the same work easily with the new cover on the new bales.

The appearance of the bale shows at once that it is a good risk in the storehouse. The compactness of the bale offers the least possible chance for hidden sparks, and we certainly ought to get much better insurance rates.

And now let me digress for a while. As many of you know, this idea of the round bale is not a new idea. It has the respectability of age stamped upon it, and is an idea upon which a great deal of time and thought has been expended.

It may surprise some of you, however, to learn that the round bale was in existence as an idea previous to the year 1844. During that year a machine for making this shaped bale was made and operated at East Bridgewater, Mass., by Messrs. PRATT and CARVER, who filed a caveat at the time, but never filed an application for a patent.

Since then many patents have been taken out, but there was little progress towards making the round bale practical until recently. Season before last, as Mr. BALL said in his article last year, the round bale was introduced and "every bale manfactured was taken".

While all these round bales had the good qualities to which reference was made last year, at the same time there have been several objections to them, and they have not made their way into general use as fast as expected.

I have looked over many patents, dated as far back as the fifties, and I have noticed that all had one main idea, the working from a centre and building out — the cotton being rolled like a lap — but each patent had its peculiar mechanical device for compressing. It was to bales made upon this idea that Messrs. KNIGHT and BALL referred last year.

Within a year, however, a new system has been invented, and it is to this new system especially that I wish to call the attention of the Association.

I have had a few bales of this new system, a system which is on an entirely different principle from all previous round bales. These were compressed on the principle of a cam of drawing, so that when the binding wires were cut the roll expanded and left the cotton in small pieces and in convenient form for mixing.

This new system compresses the bale much harder than the average American or Egyptian bale, but the manner in which it is done is not detrimental to the staple.

I consider that we are fortunate in having with us today the inventor of this system, Mr. GEORGE A. LOWRY of Boston, and he has kindly consented to explain to us his system, a system which accomplishes all that is desired of the former inventions, at the same time giving us a bale that opens easier and handier than the square bale, with as little tare as the former round bale.

The PRESIDENT. This bale to which Mr. BOURNE refers, of Mr. LOWRY'S, is further explained in the paper, "One Hundred Years of Ginning and Baling Cotton", and Mr. EDWARD M. WELD will read Mr. LOWRY'S paper, and afterwards explain in regard to the make-up of the bale.

ONE HUNDRED YEARS OF GINNING AND BALING COTTON.

GEORGE A. LOWRY, Boston, Mass.

GINNING.

In the year 1784, an American vessel arrived in Liverpool with eight bags of cotton which were seized by the customs officials on the ground that it could not possibly be American cotton; next year there were five more bags exported, six bags in 1786 and 108 bags in 1787. This was all Sea Island cotton, for until 1791, when WHITNEY invented his cotton gin, upland cotton was practically unknown. This short staple cotton adhered so obstinately to the seed that an operator could clean only one pound per day.

Two years after WHITNEY'S invention of the gin, the crop had grown to 5,000,000 pounds; ten years later to 35,000,000 pounds, and in twenty years it had grown to 85,000,000 pounds, while the estimate of the crop last year (that of 1897), is 500,500,000 pounds.

In the year 1791 two operators could produce two pounds of cleaned cotton per day. With the present system of automatic feeders, etc., only two men are required to remove the cotton from the wagon and attend to six gins producing 24,000 pounds of cleaned cotton daily.

Previous to the invention of the Whitney gin a small roller gin (invented in India some centuries ago), called a "Churka" was used. It consisted of two rollers placed parallel to each other, with a small space between, and revolving in opposite directions. One of the rollers was smaller than the other, the

smaller one being of iron and the larger of wood. The operator turned the machine with one hand, and fed in the seed cotton with the other. Only long staple cotton (which is easily detached from the seed) could be cleaned with this machine, and its output was three pounds per day. Most of the roller gins of today are modifications of this type, the widest departure from it being that of the McCarthy gin, which consists of a leather roller and two steel blades, one of the blades being pressed against the roller, while the other blade has a rapid reciprocal movement and strikes the seeds as they are drawn against the edge of the first blade, by the adhesive action of the fibres of cotton to the rough surface of the revolving leather roller. This rapid striking movement detaches the seed from the fibre.

The original Whitney gin consisted of a drum with rows of wire hooks or teeth inserted in line around it. As the drum revolved these teeth passed between a grate or gird, the bars of which were sufficiently far apart to permit the teeth to pass without touching, but so close the seed could not pass between. Another grate, wide enough to allow the separated seeds to drop through, was mounted to form a hopper for the seed cotton, and hold it against the revolving drum. The revolution of the drum, coupled with the drawing action of the teeth against the cotton in the hopper, caused the cotton also to revolve and form into a roll, thus resulting in continually presenting new material to the teeth, and giving the cleaned seed a chance to drop through the wider grate forming the hopper. As the teeth or hooks passed through the roll they became charged with filaments of cotton, and the seed being held back by the pressure of the surrounding material, or by coming in contact with the forward grate, caused the filaments to be detached from the seed and carried forward by the drum, until they were removed by a brush revolving with greater rapidity in an opposite direction, and in such a way the bristles brushed the teeth in the direction in which they were inclined. This removed the filaments of cotton from the drum, and the speed of the brush was sufficient to clear itself by centrifugal action.

Numberless patents have been issued, and a few improvements made on the Whitney gin, but the principle remains the same. Instead of the wire teeth fixed in a drum we have teeth cut out of a circular metal plate. The brush now consists of a drum with rows of bristles inserted lengthwise across it, and with wings on the ends to give an air current.* Rotating plates have been placed at the ends of the cotton roll to reduce the friction, and perhaps the most important improvement is the mote board,* which regulates the current of air produced by the wings on the brush so nicely that the current is just strong enough to carry off the cleaned cotton, but not enough to carry off the motes, or immature seeds, which thus become separated as wheat is from chaff. The addition of this air current and the passing of the cotton through flues to a lint room or condenser, also materially assists in opening up the neps occasionally caused by the films of cotton doubling around the teeth.

The lint room was merely a large compartment or box, fitted with screen ventilators into which the cotton was blown, the ventilators allowing the air and dust to pass away.

In 1878 a condenser was added and made a part of the gin. This condenser is a revolving screen, and as the cotton is blown against it the air passes through, leaving the lint on the face of the screen in the form of a bat, the air passing out through the bottom and ends of the condenser and carrying the dust and dirt with it; the screen, as it revolves, constantly presenting new surfaces to the on-coming cotton. A bat roll is placed over the top of the revolving screen and lifts the cotton from it, delivering it into a chute.

The capacity of a roller gin is about 400 pounds daily. The capacity of the improved Whitney gin is 4,000 pounds per day. A roller gin consumes 71,000 foot-pounds of power for each pound of cleaned cotton, against 35,000 foot-pounds on a Whitney for the same quantity.

The Whitney gin has, unfortunately for itself, become known

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*Invented by ELEAZER CARVER, 1845.

as the "saw gin", and I will hereafter speak of it by that term. I say "unfortunately" for the word "saw" has a ripping sound, and has resulted in the general and mistaken belief that this form of machine is particularly injurious to the fibre, while the actual facts are, the saw gin does not hurt the cotton any more than the roller gin, and neither of these gins will hurt the fibre materially unless run at too high speed, as the injury to the cotton depends upon the suddenness of its detachment from the seed. Every sample of cotton contains a portion of weak fibres, running all the way from a tensil strength of 46 grains to 212 grains (breaking strain), and naturally, the weaker fibres suffer the most in ginning. Cotton from saw gins show a little more neppiness than from roller gins, but the cotton from the latter will be more curled and twisted, and this curling in cotton is apt to result in neppiness when carded.

The cotton from saw gins is much cleaner than from roller gins, and opinions for or against these machines will depend whether most attention is shown to neppiness or cleanness. If the teeth in a saw gin are made smooth and well rounded at the root, and curved so they will enter the cotton at the right angle, they will not injure it unless run at a very high rate of speed, but it unfortunately happens that most of the ginning in this country is by custom ginners who are paid by the bale for their work, and whose interest lies more in the quantity they turn out than in the condition of the cotton after it is ginned, and as a rule they run their gins at a very injurious speed. However, they would do the same with roller gins, and the results would be equally as bad.

A number of tests made carefully on cotton from saw and roller gins show the following results, viz.:

	2.5%	degree of neppiness from roller gins.
	2.7%	" " " " saw ".
Cleanness	0.8%	of leaf from roller gins.
	0.00	" " " saw "
	1.2%	of crushed seed from saw gins.
	1.5%	" " " " roller gins.

Seven samples taken from a hank of yarn made from roller ginned cotton, showed an average deterioration of 1.4 per cent., while eight samples of yarn made from saw ginned cotton showed an average deterioration of 1.7 per cent..

If "the man who causes two blades of grass to grow where one grew before, is a benefactor to the human race", how much more so is the man who causes 25,000,000 acres of land to be tilled where one was not tilled before? This WHITNEY has done for the South, and how did the South reward WHITNEY?

BALING.

The world's exports of cotton goods amounted to about $400,000,000 in the year 1896. Of this 95 per cent. is manufactured in Europe, and only 5 per cent. in the United States, and only a small percentage of the latter is manufactured in the South, where the cotton is grown. This has necessitated shipping the greater part of the crop many thousands of miles, and a tremendous outlay for freight and bagging. To mitigate this, many millions have been expended in order to reduce the cotton to a density that will give ships and cars their full capacity of tonnage (which is about forty pounds to each cubic foot of space). There are about $70,000,000 now invested in the large compresses at central points, and about $20,000,000 in planters' presses.

The first system of baling cotton used in the years 1780 to 1810, was that of tramping and mauling it into round bags about nine feet long, and holding about 300 pounds. In this way they compressed to a density of about five pounds per cubic foot. Next were introduced the hand and horse power screw presses, and between the years 1840 and 1860 the power screw presses, and about 1870 the planters' steam press. The latter form of presses are those most in use at present, and compress cotton to about 12 pounds per cubic foot. The best results from these give but one-fourth of a load.

In 1845 was introduced the Tyler hydraulic compress and in 1874 the Morse steam compress for the purpose of re-com-

pressing the bales put up by the planters and ginners. The immense outlay for such plants prevented their erection at other than central points and sea ports, the cost for the compress alone being from $40,000 to $60,000, and requiring a steam capacity of three 150 horse power boilers. The pressure exerted by these gigantic machines is from 5,000,000 to 6,000,000 pounds on each bale, or about 2,800 pounds per square inch; the bale while under the press being reduced to about 60 pounds density to the cubic foot, but being unable to keep it from expanding when released from the press, the average obtained is only 22½ pounds per cubic foot. Very few bales "dock" at Liverpool with a greater density than twenty pounds per cubic foot.

In expanding, the bales become turtle-backed, which prevents storing them economically and necessitates "jack-screwing" into place when stored aboard ship. The regular charges at New Orleans for re-compressing, screwing, etc., are $2.04 per bale, and the job when finished is a mighty poor one.

The American Cotton Company, by their revival of the cylindrical baling machine, have done a great deal to stir up the planters and ginners to the fact that their present methods must be improved or abandoned. This cylindrical bale (which consists in winding a bat of cotton around a core, and putting pressure on the layers, as they are wound, by means of receding drums in sliding boxes held elastically against them) was first made by the E. Carver Company, at East Bridgewater, Massachusetts, in 1844, for J. E. CARVER and W. F. PRATT, who spent $2,400 on the machine, but abandoned it because the mills objected to the difficulty of unwinding and the felted condition of the cotton at the centre of the bale, caused by the layers creeping on each other, accumulating and concentrating the pressure on the core. Each layer was necessarily less dense than the layer beneath, which it assisted in compressing, and the bale could only have an average instead of a regular density, which was in inverse ratio to its diameter. (This peculiarity was strikingly exemplified some time since at the Ordnance Department, Washington, D. C., when they tried to wind a steel gun core

with wire, the result being a sufficient accumulation of pressure towards the centre to crush the core.) Patents were issued in 1847 to MEAD, and in 1848 to NORTH, for machines of this type, but until the improvements by BESSONETTE in 1893, no material progress was made in bringing it into practical use. There are now 35 plants established, which, last season, put up 60,000 bales of cotton, compressed to a density of about 30 pounds per cubic foot; the pressure exerted being 1,000 pounds to the square inch. (It must be remembered that about 17 per cent. is lost in stowing cylindrical packages.)

Between 1840 and 1850, two other forms of pressing cotton were invented, one of which had a circular tube, with a revolving head containing a number of cone rollers placed parallel to each other with a narrow space between. As the head was revolved, the cotton was supposed to feed between the rollers, but the inventor failed to notice that as one side of the roller rotated inwardly, the other side of it must necessarily rotate outwardly, thus nullifying the action of each other and preventing any drawing in of the cotton. As several other inventors have, within a few years, tried the same scheme with like results, the prior inventor (if still alive) need not feel humiliated at his want of foresight. The other form referred to was twisting the cotton into a thick rope, and coiling it on a spindle. This needs no comment.

For the past ten years. efforts have been made by several inventors to pass cotton between metal rollers held tightly together, and have the rolls move reciprocally over the receiving box, or the receiving box move reciprocally under the rolls, thus folding the cotton into layers, the box in either case having a screw, or hydraulic mechanism, attached thereto, to compress the layers of cotton. The greatest difficulty found with this type of machine has been to pass cotton between metal rolls without injury to the fibre.

As the object of the manufacturer is rather to decrease than increase the number of processes and handlings at the mill, their critical attention is particularly requested to the bales

which I will now open for them, and to the fact that they open spontaneously; that there is no felted or matted cotton, and almost no tare. For although these bales are to a density of 42 pounds per cubic foot, the cotton has only been submitted to a pressure of 55 pounds per square inch, while the Bessonette cylindrical bale requires 1,000 pounds to the square inch, and the Morse compress 2,800 pounds to the square inch, for a much less density.

The machine is unique in its simplicity, yet there are few mechanical engineers who agree as to the principle involved. Besides the driving mechanism, there are only three parts to the machine: a flanged sleeve which revolves on the shoulder of a stationary outer casing, and a slotted cap-plate bolted to it. The sleeve is first filled with cotton, sufficiently tight to give some pressure against the cap-plate. The sleeve is then made to revolve, and as the cotton is dropped from the condenser on to the cap-plate, a few fibres become drawn into the slot by the cotton moving underneath, and these fibres being entangled with others, soon draw all the loose cotton into the slot under the rounded edge of the lip: this compresses the cotton, removing the air, and there being no possibility of expansion (as there is in all other compresses) this machine gives a compression with very little exertion and holds the density obtained.

The inner sleeve is slightly funnel shaped, and gives resistance according to its length and the extent of the narrowing or choking of the chamber. A variation in its choke or length will make a variation in the density of the bale. In this way, by slightly altering the sleeve, cotton has been compressed to a density of 86 pounds per cubic foot. (Oak is 54 pounds per cubic foot.) The bale has an additional advantage in that it absorbs water very slowly. A bale dropped into the river absorbed 7 pounds in twenty-four hours, while a regular uncompressed bale absorbed 64 pounds in the same time. The simplicity of the construction and operation of this machine will permit its going into the hands of unskilled labor, and its cheapness will bring it within the reach of every ginner.

I beg to acknowledge my indebtedness to Dr. JOHN FORBES WATSON, Mr. J. E. CARVER, *Silliman's Journal* and *The Manufacturers' Record* for much of the preceding information.

Mr. EDWARD M. WELD. I want to say that this bale which I am going to open is a bale that was made on the experimental machine. It is only 16 inches in diameter and 36 inches high, and weighs 159 pounds. The bale which we propose to make will be 18 inches in diameter, 36 inches high, and weighs 250 pounds. It will have a density of about 45 pounds to the cubic foot, and it takes approximately five horse power to run the press and get that density. If there are any questions I can answer I should be very glad to do so. If you will kindly step up and look at the bale and see it before it is opened I should be very much pleased. I will drop it on the floor, and that will give you some idea of how hard it is.

[The sample bale was opened and examined by the members present.]

The PRESIDENT. Now, gentlemen, I think I can safely say that the round bale has the floor. [Laughter.] There is an opportunity now to discuss this question.

Mr. JOHN E. PREST. I have listened with a great deal of interest to what has been said in regard to these round bales and the different kinds, and the question comes home, What is the manufacturer going to get out of this? It seems to be all to help the man who gets up the round bale and the square bale. I had the privilege of furnishing the cotton to make some of the first bales compressed in Dedrick Brothers' new presses. It was put into this square bale — very nice to handle. I think I have got one of the bales now as a sample; had it about two years. It is a very good bale to handle, much more convenient

than the large bale. It takes up less room in storing — stores much better it seems to me. It is better in case of fire than the round bales; not so many holes to get through, and certainly, in that regard, it has the advantage over the round bale. The round bale, on the other hand, has certain advantages. But when we come down to the fact, we have got to pay something extra for the cotton, the manufacturer don't get anything out of it. Now we want to know what we are going to save. What can we make out of it? Shall we get better ginned and improved quality of cotton? Mr. ATKINSON says it brings a half a cent a pound more. Then the manufacturer has got to pay a half a cent a pound more. Now then, is the loss in that cotton half a cent a pound? Is the waste and the trash that they take out of it worth that? There comes a question that we want to consider, what we are going to gain out of it. If we are going to help bring about all these different processes, I think that the square bale, from what I have seen of it so far, the Dedrick bale, will prove superior to the round bale. It was two years ago, I think, that the Dedrick bale was first put out. I think I have a sample of the bale today, and I have had it for two years.

Mr. STEPHEN A. KNIGHT. In regard to the saving for the manufacturer in the new methods of baling, and as to which is the better one, I am sure I am not prepared to say today, but as I look upon the facts, it is this, that when cotton is put up in this form we get what we buy, and we do not get what we buy in the old method of the square baling of cotton. The old square bale is so much more susceptible to dampness and wet, for one thing, and we have all been so insane for a number of years past as to allow in the old method of baling, on account of its waste and tare in its ungainly condition while coming to market, five pounds to the planter or the merchant through whom we bought the cotton, as the tare. He was entitled to have five pounds. What was the result? Our bales all came ten pounds short instead of five. Every man put up his bale of cotton as you would and I would under such circumstances, for

I think men are a good deal alike; every man put up his bale of cotton five pounds short. He says, "If I don't get that five pounds I am a fool", and men are not apt to be called fools in that direction. The round bale is perfectly packed, perfectly covered — it comes to us in perfect condition, and we get pound for pound of the cotton that we buy. So far as price is concerned, an article is worth what it will bring. If we get all our cotton in perfect condition, and every man gets an equal quantity of cotton, knows what he is paying for his cotton and knows what he gets when he buys a bale of cotton, it has, to say the least, the merit of equalizing the cost of cotton to the various manufacturers, which is not the fact with the old method of baling.

For the last two years the firm with which I am connected has bought its cotton with the strict understanding that we should have net weight. That is one step that has been suggested to the Arkwright Club, that the buyer should do: that we should insist in buying our cotton, whether with the square or round bale or in any other way, that we get what we buy. I do not think that we can get cotton so dry and in such perfect condition with the old method of baling as we can with the round bale. Therefore I think that even while it is true that we have to pay something for it, it is a benefit from the fact that we know what we are buying and we get what we buy.

Mr. JOHN E. PREST. I ought to say in regard to the round bale that in a lot which I examined a while ago the weights held out. The tare was about four pounds and a half to the bale, I think. I know I had the covering taken off and the cotton seemed in very good condition. In regard to the matter of averaging five pounds to the bale short, I think it is a thing that the manufacturer ought to take up. One or two concerns, I understand, like Mr. KNIGHT'S, have been fighting it for the past year or two. They insist upon having net weights. We have been trying to do the same thing ourselves, trying to get net weights. Now if all the manufacturers will try to do

that I think it will have some effect. If only two or three try it, of course it is rather hard sledding for them. Some bales fall ten pounds short. Of course when they do that you can make a claim; but you receive 99 bales and they charge you for a 100, that is the size of it. If we would take this matter up and fight it I think we would make quite a little saving.

Mr. STEPHEN A. KNIGHT. What I wanted to impress upon the members in regard to this matter was, that while I admit that what has been said is correct, and that the people at the South, and some of them at the North perhaps will get about all they can, the condition in which the round bale has come to us thus far does not admit of the moisture that we get in the square bale, as it is dumped by the side of the track all the way from the cotton gin to the market, and the more rain they get the better they are content to let the cotton lie. Now this cotton is not so susceptible to the absorption of moisture in the new style of bale.

Mr. EDWARD ATKINSON. You have taken up a deep subject. These pestilent inventors keep coming along so that you cannot be sure that one end of a mill is first-class before the other end is all wrong. But what is it? It is part of the progress of eliminating wasteful methods. Now let us look at it in a broad way. Undoubtedly the southerners have been shiftless. The southern farmers are generally ignorant, thriftless and shiftless. They have had an apparent monopoly, and in trying to make the best of it, they have made the worst of it. They are under the duress of hard times, and there is now a very great improvement, an active improvement. There is a class of men coming up in the South, capable, energetic, forceful and progressive, and they are preparing to take a part in all these undertakings. What we have to do is to try to see that they are not misdirected, that we co-operate with them. Atlanta itself is a most remarkable example of a city built by internal energy and thrift, without a boom. It doubles every ten years, and it has the

diversified industry which ought to exist throughout the South. They are prepared to take up all those improvements as fast as they can get a benefit from them. Now what is the American Company doing? They have an ample capital. They set up their press and charge a royalty, with the condition that at least a thousand bales shall be baled on that press at that gin. They then leave with that gin manager a standing offer for all the cotton that he may bale of a quarter of a cent above the current market quotation for that grade, if he wants to dispose of it at that time. In other words, the ginner has the liberty to test the market and sell his product in the cylinder bale on his own behalf, but if he is out of money, and is prepared to take the market price of that grade of cotton on the square bale, plus one-quarter of a cent, the money is ready for it. Now under those conditions progress will be very rapid. You appeal to the pocket nerve, and that is the only nerve that can be appealed to in those matters. I hope Mr. WELD will work on the same lines, and between the two what will you gain? Suppose it to be true that the South as a section has lost $5 a bale on 128,000,000 bales of cotton since 1881. Suppose it be true, who has made it? Nobody. It is a dead waste, the greater part of it, to the southern farmer. Haven't you as great an interest in the prosperity of the southern farmer as you have in the prosperity of the western farmer? Is not your great market among the farmers and the farm laborers and mechanics and the people who work for wages? Nine-tenths of your trade, nine-tenths of the consumers of your goods, are either farmers, wage earners, or people who earn small salaries of less than a thousand dollars a year for a family of five persons. Nine-tenths of your consumption is in that class of people. Therefore every enterprise of this kind which saves what had been previously a terrible waste comes back, to your benefit, in the greater purchasing power of those whom you have benefitted by promoting the improvements.

I want to tell a story. My old friend, Governor GRIMES, was the first governor of Iowa, and he was elected for three years.

He had a geological survey made, and Iowa is full of fossils — a wonderful place for them. Among other things they found a trilobite, the largest ever found, the picture of which filled a whole page in the quarto report of the "Geological Survey of Iowa", on which it was engraved, and they named it *Scarabæus Grimesei*. His democratic opponent on the next election took the volume around under his arm during the campaign, and turned to that page: "Bug Detector, gentleman; that cost you $10,000; are you going to vote for such a man as that?" It was the hardest argument he had to overcome in getting re-elected.

The PRESIDENT. We will now listen to Mr. ATHERTON, who will read a paper on "The Excelsior Spinning Frame".

THE EXCELSIOR SPINNING FRAME.

A. T. Atherton, Pawtucket, R. I.

This method of spinning was devised for the purpose of doing away with roving frames, in the spinning of the coarser counts of yarn; that is, the product of the slubber is placed in the creels of this frame, to be spun into yarn thus saving a large portion of the cost of roving machinery in the first place, and being also a means of economy subsequently in saving power and wages.

Although it might at first appear that the loss of the doubling on the fly frames would effect unfavorably the eveness of the yarn, the fact is that the yarn spun by the Excelsior process is as even as, and sometimes breaks stronger than that spun from roving which has undergone the uneven stretching process of fly frames. Many carders have tried to prevent this unequal stretching, and the resulting injurious effect which the flyer usually exerts upon the roving; and it is only by the use of exceptional care and the highest skill that success has been attained in this direction. When this point is considered it is not so remarkable that, in spinning yarns up to No. 20s, the Excelsior system has proved uniformly successful and it is more than possible that it will be proved economical on even higher numbers.

The Excelsior system consists essentially of drawing the roving between the back and middle rolls to the extent usual on roving frames and then, by a patent condensing motion, preparing it for the spinning draft, which takes place between the middle and front rolls; thus obtaining in this frame, the roving drafts, multiplied by the spinning frame draft, without the usual bad

effects which are experienced when excessive spinning frame draft is attempted in the usual way, because the latter is practically wholly obtained between one pair of rolls, namely, the front and middle ones.

It has taken some years to bring the patent traversing condensing process into practical form; but, as constructed at the present time, there is no reason why the frame cannot be operated by the ordinary help with equal facility, and with at least as good results, as on the standard frame. In fact, this has been proved wherever the machine has received a fair test.

The condensing guide placed between the front and middle rolls, receiving its motion from the same source as the roving traverse on the back of the rolls, is so shaped as to be self-threading whenever the roving is broken back, and as this does away with the need of extra care on the part of the spinner, it is a very important feature of the frame.

The condensing guides are made of brass, and adjustably attached to a steel traverse rod, so that when once set on the rod and connected to the back roving traverse rod, it requires no further attention. The simultaneous action of the two traverse rods is an important feature, inasmuch as the possibility of straining the roving unevenly is thus entirely obviated. To ensure uniformity of draft, without undue weighting of the rolls, the back top rolls are made metalic and carefully fluted. The draft gearing on this frame is arranged so that changes may be made in the draft between the back and middle rolls, as well as between the front and middle, so that a total draft of 40 may readily be obtained if necessary or desirable.

It is frequently urged that one great objection to the Excelsior spinning process is that it does away with a necessarily large amount of doublings and consequently it is impossible for it to produce as good yarn. As an answer to this objection, we have to state that doublings are absolutely necessary in working according to the common methods, because of the amount of twist necessary in the roving to enable it to be carried through the intermediate and fine roving frames, but as there is practically

no twist in the roving delivered to the Excelsior frame, two, and sometimes only one, doublings are necessary in order to ensure eveness of yarn.

Several years ago, during the infancy of the Excelsior system, being desirous of testing the matter of doublings necessary to the successful making of yarn, I called at the Victoria Mills, Newburyport, Mass., and obtained from Mr. STILES, who was then agent, some 50-grain sliver of cotton from a single experimental card which he had on trial, and putting the same into a hat box, I carried it to the Everett Mills, Lawrence, Mass., and put it on the creel board of a spinning frame which had been changed over into the Excelsior system, in its then unperfected condition, and was engaged in spinning No. 10 yarn. It will be remembered that the only doubling this sliver had received from the bale was three laps into one on the finisher picker. The sliver was fed to the spinning frame, over the edge of the hat box, and never broke down from the time it started until the entire amount had been spun into yarn. This yarn when tested broke up to the United States standard and the extreme variation in the different tests made for eveness, was less than seven-eights of a number.

So much for the doubling theory, when practically untwisted sliver is used on the Excelsior spinning frame. There is no doubt that a fair trial of this frame, and a consideration of the economy which it effects, will result in its adoption for at least the coarser and medium counts of yarns.

The PRESIDENT. Gentlemen, have you any question to ask of Mr. ATHERTON, or anything to say?

Mr. ATHERTON. I would say, Mr. President, that I have some samples of yarn that was spun by the process before it was in its present perfected condition, which I think speaks very well for it. The members can help themselves.

The PRESIDENT. What draft, about, on this?

Mr. ATHERTON. I don't remember, it is so long ago. They are all tagged.

The PRESIDENT. We have a little time left this afternoon, and there are placed on the programme three topical questions, and if there is any desire on the part of any of the members to take up any one of the three we will do so. One is on the systematic method of costs for weaving, another on the economical range that ring filling frames may be used in competition with mules, and the third in regard to overseers in large manufacturing plants. Is there anything to be said about topical question 91: Can a Systematic Method of Costs be Determined for Weaving?

Mr. CHRISTOPHER P. BROOKS. Mr. President and gentlemen, topical question No. 91, "Can a Systematic Method of Costs be Determined for Weaving", is possibly a little bit indefinite in the matter of clearly indicating whether the intention is to arrive at the cost of wages for weaving or the general expenses for manufacturing the yarn into cloth. When I saw the question I thought it might be of some interest to you to explain what I had noticed as being the system adopted among English manufacturers in determining these costs, and I refer now to the whole of the expenses between the yarn and the cloth. The system in England is somewhat different from what it is here, for the most of the manufacturers buy their yarns and sell the cloth. Spinning is an entirely separate business from weaving. Most of the manufacturers, in fact, I think all the manufacturers, are members of the Royal Exchange at Manchester, and they attend this Exchange every day or two, coming in contact with merchants who receive inquiries for goods from all parts of the world, expressed in the unit of money of the country from which the inquiry comes. The merchants convert these foreign monies into English money and make an offer to the manufacturer in

the Exchange for a hundred bales or a thousand bales at a certain price. Very often he has only fifteen or twenty minutes in which to make his figures and say whether he will accept the offer or not. Owing to this system there has sprung up a very admirable manner of rapidly arriving at the cost of manufacturing, and it is somewhat upon the following plan.

You are all aware of the rules for finding the weight of warp or filling. After calculating these weights, the weaver obtains yarn prices from the spinner, who may be at his elbow in the exchange, and figures out the cost of yarn per piece. After this he consults what is known there as the Universal List of Weaving Prices. This is a standard list of wages agreed upon between the employers and employed in the weaving industry, and probably regulates the wages on over four hundred thousand looms in Lancashire. It is based on a certain price for a specified length and width of cloth of a certain number of threads and picks per inch, and specified numbers of yarns, allowances to be made for any variations from these particulars, details of which will be found in the transactions of this Association, published about four years ago giving the calculated prices for weaving according to this list. On some goods it was then the custom to add one more weaving price, which was found to cover the cost of manufacturing the cloth. During recent years, owing to the improved machinery and increased economy and greater competition, manufacturers have been unable to obtain this price, known as "doubled weaving" and are found content to add three-quarters of the weaving price, or even two-thirds on special classes of goods. It has been found in practice that this three-quarters of the weaving price is sufficient to cover all expenses of spooling, warping, slashing and loom fixing, rent, lighting, power, insurance, supplies, selling expenses, and, in fact, everything that enters into the cost of cloth outside of the weaver's wages. The same percentage of a weaver's wage that would cover all these expenses in England will of course not apply to the United States, as the rate for weaving is different; but the principle remains the same, and I think it might be interesting

to manufacturers to investigate this matter and see why they cannot adopt this ready system of immediately finding out the cost of a piece of cloth. First calculating the value of the warp, then the value of the filling, then adding an estimate of the loss in waste, the price paid to the weaver, and afterwards such a percentage of one weaver's wage as is found applicable to American conditions. There are undoubtedly every week millions of dollars' worth of cotton goods sold on the Manchester Exchange on this system. I do not know whether that is exactly the method of costs referred to by the propounder of this question, but if it has added any light to the subject I shall be very glad, and if there is any question that I can answer I shall be pleased to do so.

The PRESIDENT. If there is nothing farther to say on No. 91 we will pass to No. 92. Have the gentlemen anything to offer under Topical Question No. 92: "Where is the economical range that ring filling frames may be used in competition with mules; that is, the lowest and highest number of yarn?

Mr. HENRY T. WHITIN. I am under the impression that Mr. ECCLES has been investigating that subject somewhat; and if he would be willing to give his experience I think it would be interesting.

Mr. JOHN ECCLES. I beg Mr. WHITIN'S pardon, but I don't think that I said that I had anything to say on this particular question.

Mr. HENRY T. WHITIN. I understood that you had been looking into it.

Mr. JOHN ECCLES. I had tried to interest the Board of Government in trying to get Mr. G. MARSTON WHITIN here, who would possibly advise us what progress had been made in that direction. I presume probably there has been something

done about it, but for myself I have no information or advice to offer. I should be glad to hear from someone who has. If there is anyone here from the King Philip Mill, I believe they are doing a little of it in that place, and possibly they might give us some advice, or some of our Fall River brethren, anyway.

The PRESIDENT. Perhaps that question may be taken up at a later session. Shall we hear from any of the members on No. 93: "In large manufacturing plants, having a number of rooms on each principal operation, which is the better to have one overseer or department man in charge of each special operation or to have a number of men in charge of smaller sections?"

I will call on Mr. GULLIVER.

Mr. ARTHUR H. GULLIVER. Mr. President, it seems to me that that question is one that is worth some consideration. I am very much in favor of believing that the larger the department the better the result. I do not believe in subdividing in any department and putting one man in charge of one section. There are two reasons that I have for holding this view. One is that you get a great deal better men. I know in a case of my own experience where one man has been put in charge of two rooms in place of one, or of two departments in place of one department, the very fact that the man is put on a little higher plane and gets a little more money for it, makes him a better man, even though he may have seemed to have had just about enough to do in his former position. I do not believe there is a gain in dividing rooms, unless in competition. That is the only point in which it would come up. I do not believe there is any gain in giving a man a smaller amount of work to look after than he can manage. A second point is this, if a man is put in charge of two departments, the man under him, whether you call him second hand or section hand, has a little more responsibility thrown on him, and if he is inclined to come up to the responsibility, it tends to make him a better man, and you get an advantage in both ways. That has been my experience in

some changes that have been made recently under my own supervision. I know we have made a gain not only in quantity and quality, but we have improved the second hand and several of the men on whom this extra responsibility was thrown. It seems to me that there can be a great deal of economy in that way, by enlarging the amount of work that one overseer or one second hand has to look after. And I would say, further than that, that I believe it pays, in a small plant where the second hand has only a small amount of work to do necessarily, to give him charge of a section in addition to his being second hand, though not have him hold this position except when the overseer is out of the room either through sickness or necessary absence. One department under my charge is handled in that way; and although it gives the second hand a little larger pay than any other second hand in the mill, it is an advantage. He has a regular section to look after, and as long as the overseer is in the room, he attends to that; when the overseer is out he takes his position as second hand and fills the overseer's place; but during the regular running of the work he runs his section, and does good satisfactory work on that section in addition to the little supervision he has to do under the charge of the overseer.

I don't know but I ought to say that I did not put in this question. I have simply stated these things as they occurred to me after reading the question over.

Mr. JOHN ECCLES. I would like to ask Mr. GULLIVER how large a room he refers to, where the second hand will run a section of looms and be second hand in the room? How large a room is it?

Mr. ARTHUR H. GULLIVER. I would answer by saying that in my own case it is a room of 716 looms, but I know of a case where there are more looms than that. I think I am right in saying that there is a mill run in that way where there are 1,000 looms, and the second hand takes a section even under

those conditions. Of course we are looking for economy in every direction, and there is certainly no economy in putting two men to do one man's work. Of course there may be circumstances that will make it impossible to have such an arrangement. This work I speak of is all one class of work from one year's end to the other, and of course the supervision of the room is limited to regular routine duties.

Mr. O. B. PARKER. I would like to ask Mr. GULLIVER if he doesn't think it is a fact that the loom is stopped while that man is acting as second hand and has a section to take care of?

Mr. ARTHUR H. GULLIVER. I should have to answer that question by saying that the man does not act as second hand while he is running the section; but what I mean to say is that he, for the most of the time, is running a section of looms, and the only time he is a second hand, in the usual sense of the word, is when the overseer is out of the room.

Mr. O. B. PARKER. Then who takes his place when the overseer is out?

Mr. ARTHUR H. GULLIVER. We put a man on; a weaver is put on to run his section. We do not keep a spare man for that position. He runs a set of looms except when doing this work. He is very glad to do it because it gives him some experience.

Mr. JOHN E. PREST. I would like to ask how the mill is divided? Suppose there are two separate rooms, do you have one overseer for two separate rooms, or is it all under one overseer, or are there two separate buildings?

Mr. ARTHUR H. GULLIVER. Mr. PREST'S question brings up the matter of competition. If you have two mills that run identically the same class of work, and it is the part of

economy to get the largest amount of product, you may gain by having two overseers in competition. If it means that you are going to have the man that has charge of both rooms lag behind, I should say it would be very poor economy to do it. Outside of that I should say it would be economy, within certain limits, to use one man for two rooms, even if they were in separate mills.

Mr. JOHN E. PREST. I would say, in reply that I had some little experience years ago when we put in one overseer to take charge of two mills. In about six months we changed back again, an overseer in each mill, and found we had better results. The help very soon found out when the overseer was absent from one of the mills. We certainly got better results, got our work cheaper, when we had one man at each mill. It made a little competition between them. Two rooms in the same mill might answer very well, where he has only to go up and down stairs. I know a case of that kind now, where an overseer is in two rooms, and I know another case where the overseer travels to four mills. Well, he spends the most of his time traveling around. It takes too much time, and could be divided up with better results.

Mr. O. B. PARKER. I would like to ask if those two overseers met on the stairs and stayed there an hour or two talking, what would they amount to? [Laughter.]

Mr. T. W. WILMARTH. I would like to ask what the superintendent would be about all the time the couple of overseers were out?

Mr. JOHN E. PREST. Perhaps the superintendent would be down at the other mill.

The PRESIDENT. We have two or three minutes more on this question. Mr. PARKER, can't you give us something on it?

Mr. O. B. PARKER. I have nothing to say on that subject.

The PRESIDENT. This is a very important question, I think, for any person who has a plant of any size to place overseers over, just how he is going to do it. It seems to me that the personal element enters in. Some overseers are better for handling large territory, some are better for details. It seems to me it depends largely on the overseer himself, the kind of a man you have.

Mr. STEPHEN A. KNIGHT. I would like to inquire if it would be economy, if you have got a 100 horse power engine, to attempt to make that drive 200 horse power? It seems to me that is just about the size of this whole argument. It depends entirely, it strikes me, upon the amount of labor that the party you are adding to or taking from has to perform. If a man has got all he can do on his hands, I don't believe there is any economy in giving him more. If he has got less than he can do it may be economy to give him more. It strikes me that there is but little to be said on the matter in the way in which it is put before us.

The PRESIDENT. Well, there is a little different point than that. The overseer's duty is not exactly one thing all the time. That is, he has charge of persons, but he also has charge of machines; and if it is a small room that he is overseer of he doesn't need as much assistance. That same person may be placed in charge of two or three rooms and have more assistance in each room, and yet use his ability in the placing of the operatives and the deciding of important questions relative to the operatives, and give valuable assistance in the work on the machinery. It is really a distribution, in this case, of labor. There is a point there, I think, not in the interests of economy at all, because it may not cost any less per day, and yet you might utilize your overseers and second hands to better advantage. However, I think it is an interesting point to study over.

If any person has had any experience in making such changes, and has profited by his success or failure in it, we should be glad to hear from him.

Mr. ROSCIUS C. NEWELL. Mr. President, I have had a little experience along that line. In one instance I have two overseers in charge of what is now two departments, formerly one, and I am having better success in that department than I was before. In another instance I have one overseer who is in charge of one department which was formerly two, and I am having better success in that section than I was before. As the President has suggested, I think it depends altogether upon the individual and upon the circumstances connected with it. I do not think that any general rule can be laid down which is equally applicable in all cases. I have found that in making such changes before, I have made mistakes, and I have tried to profit by those as well.

The PRESIDENT. If there is nothing more to be said the meeting will now stand adjourned to ten o'clock tomorrow morning.

THIRD SESSION.

THURSDAY MORNING, APRIL 28, 1898.

The meeting was called to order at 10 A. M., President EATON in the chair.

The PRESIDENT. The first paper this morning is on "Steaming Filling", by Mr. EDWARD A. MONGEON, Blackstone, Mass.

STEAMING FILLING.

EDWARD A. MONGEON, Blackstone, Mass.

The object of steaming filling is, as you all know, to set the twist in the yarn so that it may be woven into cloth, and not have the yarn kink in the cloth.

There are perhaps very few persons present who have had any connection with a cotton mill where cloth is made, who have not had more or less to do with this subject.

In the early history of cotton weaving, cop yarn was allowed to stand for a considerable length of time in some convenient damp place, wheel pits, usually, to set the twist. This method proved sufficient for small mills, but large mills could not spare room enough to set the twist in this way; the large amount of yarn required to keep them running eventually resorted to the use of steam for setting the twist and this method is still in vogue in most of the cotton mills.

Some manufacturers have been to great expense in fitting up rooms for steaming their filling; others have made inexpensive places. None of these methods have given perfect satisfaction in all respects.

There are but few of these steam boxes that will not spoil a large amount of filling each time steam is admitted to them. I will name four causes: first, stained cops, caused by stained water falling from the ceiling of the box; second, soft cops, caused by intense heat admitted to the box in order that the filling may be steamed in a short time. The intense heat closes up the spindle opening in the cop, causes it to feel soft, and many of them are stabbed by the weavers in trying to put the spindle through the cop. These cops are then consigned to the waste box, or thrown under the loom to be made dirty, then to be swept up and sent to the waste house as sweepings.

Third, stained yarn on the paper tubes. This is caused by the high temperature which stews the oil out of the paper tubes, this in turn staining the yarn on the tube, making dark, oily streaks across the cloth from one-sixteenth to one-fourth inches in length.

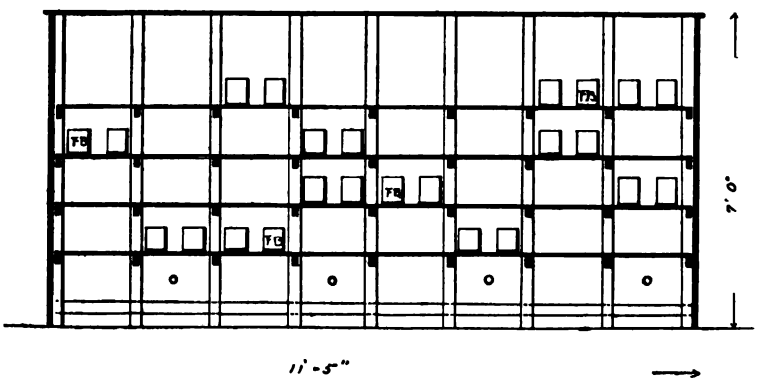
Fourth, filling boxes are spoiled by being subjected to such intense heat. It stains the wood in time, and this wood in turn stains the filling which may lie on the sides or bottom of the box, as well as shortens its usefulness as a good filling box.

To overcome this waste of material which is conceded to be enormous, we experimented with one of Mr. O. B. TRUESDELL'S patent atomizers, and was very much gratified to find that the twist in filling yarn could be set in about three and one-half hours by admitting a small amount of steam, in a tight box, through one of these atomizers. After experimenting with one of these atomizers a sufficient time to be convinced that we could accomplish what we had in view, we had a tight box constructed large enough to hold fifteen hundred pounds of filling, and so arranged that the filling boxes did not touch each other. The box is made of North Carolina hard pine seven-eighths of an inch thick, plowed and matched; the floor laid sloping from the sides to the center and covered with zinc and a drip leading from the lowest place. Near the top of the box on the sides are ten one-inch holes, these to allow hot air to escape and assist in circulation.

We then placed six atomizers around the box, three on either side, and about ten inches from the floor of the box. The nozzle of the atomizers were placed in the centre of a one and three-quarters-inch hole bored through the side of the box. As the steam rushes through this opening it causes a large amount of air to rush into the box at the same time. This supply of air assists in making a very heavy fog inside the box and also helps to keep the temperature low, which has never exceeded 110° Fahrenheit, inside the box. One can enter the box at any time if need be without any danger of being burned, and this when the steam is fully turned on.

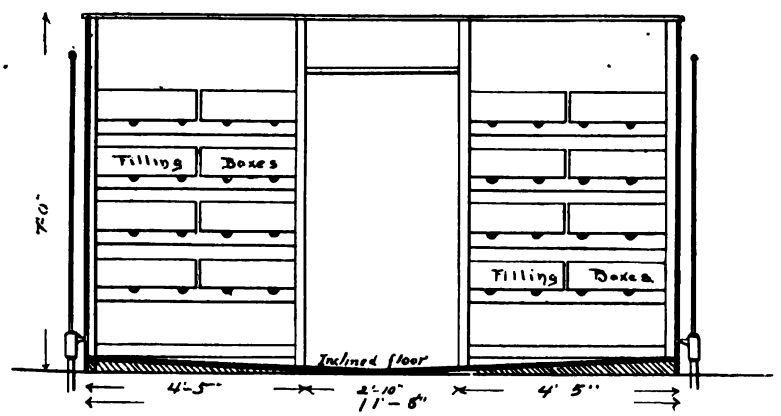
We have been using our new box for fifteen months with the very best of results. We have reduced our cop waste account nearly one-half.

We never see any stained cops and they come out of the steam box as hard as when placed in the filling box in the mule room. Neither do we have any dark streaks across our cloth from the last end of the cop.



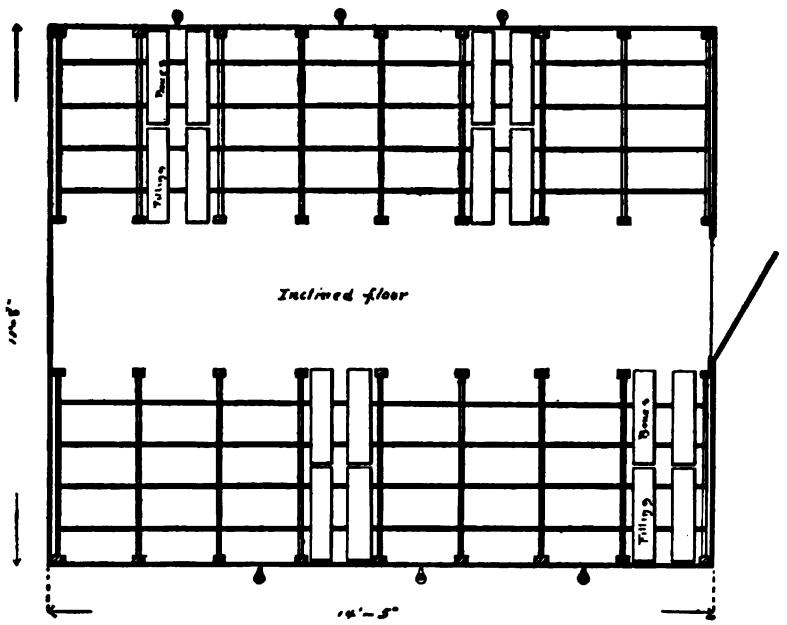
VERTICAL LONGITUDINAL SECTION

FIGURE 1.



VERTICAL CROSS SECTION.

FIGURE 2.



PLAN IN SECTION.

FIGURE 3.

The PRESIDENT. I would like to hear from the gentlemen present in regard to this subject of steaming filling as referred to by Mr. MONGEON, or any other method that any member is familiar with that would be of interest to us. I would like to inquire in regard to the length of time taken. That named by Mr. MONGEON seemed rather longer than some might wish to give to the steaming. I would like to inquire of Mr. O. B. TRUESDELL in regard to that point, or any other point of his method.

Mr. O. B. TRUESDELL. I would say that I have not had a box rigged up yet, and so I could not say as to that. It seems

to me that the length of time is longer than what would be actually necessary, although I do not know. Mr. MONGEON has tried it so long that he knows more about it. Possibly if there were more heads in, it would do the work quicker. But I guess it will work all right. I have now my steam box arranged to steam about 1400 pounds of No. 36 filling in one hour to one hour and fifteen minutes.

The PRESIDENT. This is one of those little matters that is so extremely important to cotton mills. There are very few things of importance in cotton mills except little matters.

Mr. TRUESDELL. I would like to say that I think one great advantage is in the coolness of the box, not having such intense heat. With these vaporizers the temperature in the box is so low that we do not get those soft cops, they do not close up. By making the holes in the side of the steam box 2½ inches, in place of 1¾ inches, as Mr. MONGEON has his, where the nozzle of the vaporizer is inserted, and leaving a good vent at the top of the box, the filling will take the moisture much more quickly, and the vapor will leave the box, so that the filling can be removed in ten minutes, after the vaporizers have been shut off.

The PRESIDENT. We should be glad to hear from any member who has had experience in regard to treating filling in any way other than the old method, or any suggestion in regard to it.

Mr. O. B. TRUESDELL. We take steam from the steam pipe direct, and in passing through the vaporizer it changes it to a cold vapor; instead of having hot steam it changes to cold vapor, and gives a regular vapor instead of hot steam. It does the work very well.

The PRESIDENT. Does it not also have a water pipe?

Mr. O. B. TRUESDELL. No, sir; it is simply the steam going

into the vaporizer, and at the bottom is attached a condenser. A long pipe runs down about two feet, and the steam condenses in that, and inside of that there is a smaller tube with very small holes at the bottom, and then small holes at the top of this pipe, where the steam goes through, and it draws the water up with it, and it is a cold vapor when it comes out.

Mr. STEPHEN A. KNIGHT. I would like to inquire of Mr. TRUESDELL if there is any difficulty with the condensation on the top of the box, so that it may drip down?

Mr. O. B. TRUESDELL. I could not answer that, because I have not made a box that way yet, but I understand from Mr. MONGEON that there is not. That is one point; he says he gets no dripping from the top of the box.

The PRESIDENT. We would like to have Mr. MONGEON tell us the answers to one or more questions that have been asked. Mr. STEPHEN A. KNIGHT has inquired whether you find any trouble with the condensation from the top of the box, and also from one box to the other?

Mr. EDWARD A. MONGEON. Not in the filling box; simply on the ceiling of the large box there is a slight condensation, but we have no difficulty from that. The wood has not become stained enough to stain the water which condenses, and therefore it does no harm to the filling. Our box has now been in use fifteen months. We have not discovered any stain from the box or on our yarn as yet.

Mr. STEPHEN A. KNIGHT. Is there condensation enough so that it drips somewhat from the top of the box?

Mr. EDWARD A. MONGEON. A slight condensation and drip.

Mr. EDWARD A. MONGEON. There is such a thing in existence as a cold water atomizer already. I understand that the

Edwards Manufacturing Company of Augusta, Maine, have a Garland atomizer doing the same as we are doing with steam.

Mr. JOHN E. PREST. When this box gets a year or two older may there not be trouble?

Mr. EDWARD A. MONGEON. Perhaps we may have to put a new ceiling in, at small expense. Of course we have not experienced anything of that sort yet, on our fifteen months' trial. The temperature is so low that the wood will retain its natural color for a long time. We put in 300 new filling boxes a year ago last December, and the wood inside of the boxes has hardly discolored yet, and they are in the box probably every other day. We steam our filling twice a day. We put in standard twist, No. 36 yarn.

A MEMBER. No. 36?

Mr. EDWARD A. MONGEON. Yes, sir. Mr. LAWTON, I think, in a mill in the southern part of the State of Rhode Island, has a box where he is steaming No. 70s. I asked him yesterday if he had any trouble. He said he had no trouble whatever in steaming No. 70 yarn. Of course we simply experimented with what work we had at our own mill, and we trust that others will venture into it.

The PRESIDENT. May I inquire if the roof of your steam box is level or pitched?

Mr. EDWARD A. MONGEON. It is level.

Mr. STEHHEN A. KNIGHT. Have you tried the experiment of ventilating that through the roof?

Mr. EDWARD A. MONGEON. No, sir.

Mr. STEPHEN A. KNIGHT. In your opinion, would that obviate the condensation without injuring the working qualities otherwise?

Mr. EDWARD A. MONGEON. I hardly think it would, because we have now small holes in the top of the box, just below the

roof of the box, where we allow the hot air to escape. We see no steam coming from those holes. In just putting the hand there we perceive a little heat.

The PRESIDENT. Has any gentleman any further inquiries to make of Mr. MONGEON in regard to this method?

Mr. JOHN K. RUSSELL. I would like to ask if you have used this in connection with bobbin filling?

Mr. EDWARD A. MONGEON. We never have, but I have no doubt but what it could be used in bobbin filling by not using so much steam, a small quantity, and admitting water with the steam. It would be very detrimental to the bobbins to use a great deal of water.

Mr. FRANK M. MESSENGER. I will say that we use a similar arrangement with bobbin filling. We built a steam room, plastered it with Portland cement, with a Portland cement bottom, and intended to moisten the filling with cold water vapor, but we found that it took three or four days to set the twist sufficiently with cold water vapor, and even then the filling inside and bottoms of the boxes were not sufficiently moistened, and in standing so long the steel rings on the bobbins would rust and give trouble. So in connection with the cold water vapor we put in steam, similar to what Mr. MONGEON has done. We put in cold water vapor and steam with it; very little steam. We keep the temperature of the room up to probably 80 and it works very nicely. We keep the filling in, about four hours. There is no positive injury to the bobbins. We have been running it about a year now, and the bobbins look almost as fresh, new and nice as the day they came from the shop.

Mr. THEOP. W. WILMARTH. I would like to ask Mr. MESSENGER what the humidity is.

Mr. FRANK A. MESSENGER. I am unable to answer that question. I know we tested it at the time we first started, but I

don't remember now. My impression is that it isn't much higher than we want on heavy weaving, probably about 80 degrees. We carry about 72 degrees in the weave room. That is my impression. Possibly I am wrong. We don't keep a hygrometer there. We have rules for steaming; open the valve and let the steam through a certain sized aperture a certain length of time; it works all right.

The PRESIDENT. Are there any more questions to be asked of Mr. MONGEON? He is prepared to answer anything in regard to his method.

Mr. STEPHEN A. KNIGHT. Mr. MONGEON speaks of a fog being created in the box by the introduction of the air and water. Is that fog of sufficient density so that it can be observed with the naked eye?

Mr. EDWARD A. MONGEON. Yes sir. If a person goes into the box when in operation and stays there a few minutes, when he comes out his clothes will be covered with little particles of dew, the same as going into a dense atmosphere, in a fog, in the morning.

The PRESIDENT. Before leaving the subject we would be very glad to hear any further remarks that may be made on the line of setting the twist in filling. I presume there are several methods that have not yet been brought up at this meeting.

Mr. JOHN ECCLES. I would like to ask whether there are two pipes or one pipe. I don't just understand the system properly.

Mr. EDWARD A. MONGEON. We have a vapor steam pipe for the weaving room, and we take steam from the bottom of the pipe, so as to get as much moisture or condensation as there is in the pipe for our steam pipe, and we come up to our steam box in the center, and branch off and go on each side of the box, and we drop down to the side pipes, to the bottom of the

steam pipe, and enter at the bottom. The point of the nozzle of the atomizer stands about an inch away from the hole in the side of the box. If a person holds a handkerchief up to that hole, and lets go, the steam will draw it right into the box, if it isn't too large. At one time we used water in connection with the steam, but we found that was a little too much moisture, so we take the steam now from the bottom of our vapor steam pipe, so as to get all the condensation there is between the boilers and the steam box.

The PRESIDENT. If there is no objection we will next take up the paper by Mr. CROMPTON on "The Shuttle Shifting Loom".

The SECRETARY. I have received a telegram from Mr. CROMPTON saying he is unable to be present and wishes me to read his paper for him.

The Secretary read the following paper:

THE SHUTTLE SHIFTING LOOM.

RANDOLPH CROMPTON, Worcester, Mass.

In Mr. NICHOL'S paper, "Recent Advances in Weaving," delivered at the last annual meeting of this Association, among other things, he touched briefly upon the Crompton shuttle shifting loom. At that time, to be sure, the loom was in its infancy, but those most interested in its outgrowth could see no harm in acquainting the public with the fact that the Crompton & Knowles Loom Works had such a loom in actual operation, changing its shuttles automatically. This early announcement accelerated many necessary improvements, for the cotton manufacturer all over the country, wishing to acquaint himself further with the loom, placed a considerable number of small orders and thus we benefited early by his criticism. Had we waited until the loom had reached its present state of perfection before introducing it to the public, it would have taken considerably longer to have attained it. The textile papers during the past year have been urging us strongly to supply them with data for an article; we have refrained from acceding to this request, for the brief announcement made a year ago has launched upon us more orders for this loom than we could properly attend to, for it must be remembered our experiments necessarily consumed much time. We feel now, however, that this experimental stage has passed and that the automatic loom as it stands today is a simple, practical machine, one which will make the manufacturer of plain goods able to obtain a greater production at a decidedly less figure.

Mr. NICHOLS, in his address, stated that "anyone who attempts to treat of advances in weaving will find upon further

examination that the most beautiful and complicated products of the loom contain no new principles, and do not excel in fineness fabrics that have been woven very many years; and that in the minds of some he may be thought guilty of exhibiting as new, fabrics containing ideas worked out long years previously". He then proceeds to show that great advance has been made, however, by the combinations of mechanisms, and that automatic looms are a marked advance. Mr. NICHOLS could well have carried his point further, and without detracting from the merits of the automatic loom could have stated that this seemingly new thing has been worked over, and twisted into different forms and shapes by English and American patentees a surprising number of times.

I do not mean to state that the automatic looms referred to have ever come into extensive use, but it seems as though some of the descriptions embodied practical ideas. So many attempts to introduce an automatic loom having failed in the past, the cotton manufacturers became skeptical as to its ever succeeding, but the past few years should have eliminated most of their doubts. Why we feel confident of success with the shuttle shifting loom is, because the motion which performs the automatic change of shuttles has been built by us for over a dozen years for drop box work. It was this motion that made the Crompton gingham loom and still holds it the standard for gingham work. Through all these years it has proven the most accurate drop box motion. At the World's Columbian Exposition in Chicago in 1893, a gingham loom with this motion was operated at 275 picks per minute, weaving perfect cloth. This was done simply to show its accuracy and strength, for such a speed is out of the question in a gingham mill. There is no reason why the shuttle shifting loom cannot be run at that speed were it practical to do so, for its mechanism is essentially the same.

The loom described to you last year, with a few improvements, was the first loom we produced to change shuttles, and it required more mechanism then than in its present state, for, during the past year, we have constantly employed from forty

to fifty mechanics and draftsmen improving and simplifying, and today the loom stands as a skeleton of its former self. We all know well the necessity of reducing as much as possible the working parts of any machine; and that the modern machine which has so greatly advanced the art is in most cases simpler than its predecessor. Although after a year of constant work in this direction there may still remain some unnecessary parts on the shuttle shifting loom, inspection will show that to rob it much more would be to reduce it again to the plain cotton loom upon which we started our earlier experiments a few years ago.

Changing shuttle looms prior to this one were without exception built on one broad principle — the problem before the inventor was evidently to find a means by which holding the shuttle in a receptacle it could be forced therefrom into the moving lathe. One can readily understand that to do this, the loom running 190 to 200 picks a minute, would require a sudden operation.

Having thoroughly convinced ourselves that there was merit in a continuous running loom, but that this way of placing shuttles into a loom running at such a speed was impractical (as the shuttles in a short time would become damaged by such harsh usage), and believing the uncertainty too great, the minds of our inventors turned to find a means by which a change of shuttle might be made, taking advantage of one entire revolution of the crank shaft, to insert the spare shuttle. After considerable time had been spent in trying to contrive such a method, we were fortunate enough to produce the present loom. The principle involved is an entirely new one, as novel as any we have introduced in fifty years of loom building. Its novelty will be more clearly understood by comparing this loom with the former attempts, more or less successful, in this way: the shuttle shifting loom as built by the Crompton & Knowles Loom Works never places the shuttle in the shuttle box or feeder *B*, from which it is to be thrown through the warp, except by hand. This is done, of course, while the loom is weaving. In all former looms of this class the shuttle, after being properly

placed, is automatically inserted by some suitable means from its holder into the shuttle box; some are forced in over the top of the box, others through the side of the box, but the method employed in the shuttle shifting loom, as already stated, is entirely different. The shuttle is placed upon the shelf, or in the auxiliary shuttle box, while the loom is in operation, which has already been described in the paper referred to. The method then employed to throw the shuttle through the warp and place the exhausted shuttle on the shelf, or in the catcher *D*, in both the old and present loom is practically the same. In these looms the running shuttle box *C* is displaced by the box or auxiliary shelf *B*, the latter taking the place of the former; and when in line with the race the shuttle is picked across the loom. The elevated box with the receding of the lathe deposits its exhausted shuttle into the catcher *D*, and with the next forward movement of the lathe, the feeder or auxiliary box is dropped, by the box motion *A*, into its normal position. You will see by this that we change boxes, in shifting shuttles, and that the shuttle to be inserted into the loom is never moved until picked through the shed. To be sure, the receptacle itself is moved, but this is of iron and consequently is not so fragile as the shuttle. Moreover, availing ourselves of the entire revolution of the crank shaft, we obtain a very easy motion to the feeder. We are the first to adopt this principle and control it in its broadest sense.

The changes we have made on this loom during the past year, by which its working parts have been reduced fully one-half, consist of the entire elimination of the drop box cylinder; where we formerly used the pattern chain to start the box motion, a direct connection from the filling fork is now employed; the doing away with the spindle, substituting the leather picker for the raw hide picker as used on fancy looms, and the turning of the auxiliary box into a flat piece of metal. Also where formerly we used stops, attached to the running shuttle box, to hold it from dropping further than the level of the raceway, we now substitute a rod *K*, which connects with the feeder

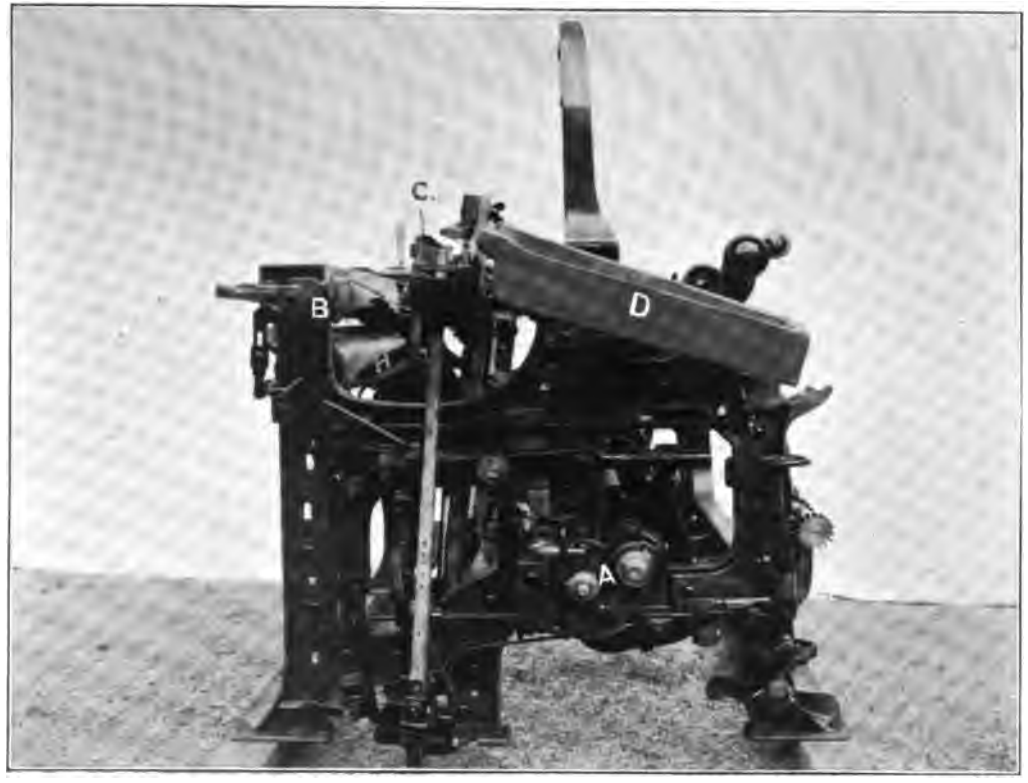


FIG. 1.

FIG. 2.

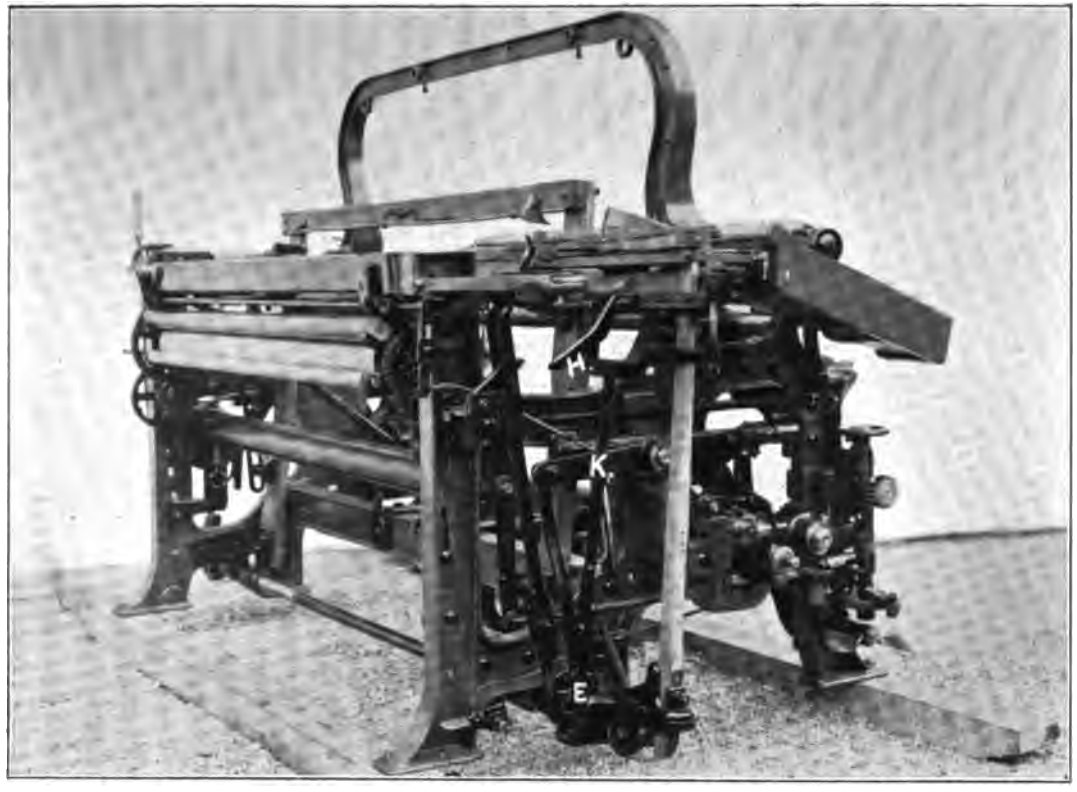


FIG. 3.

rod at *E*. By so doing both boxes are raised and lowered positively where formerly the running box was lowered by gravity. This has enabled us to attain any desired speed. There has also been made one other very important change — we have been able to abandon the hook which formerly held the auxiliary box forward from contact with the lay, in the old way the hook was lifted by the filling fork and the auxiliary box receded with the lay, taking its place beneath the running shuttle box (this was done by means of a spring); it was then lifted to the level of the race plate by the box motion.. We now raise the running box and feeder at the same time the feeder in its upward movement as the lay is receding, by means of the finger *H*, is caused to take the same lateral position held by the running box when weaving. There are two movements to this feeder, which has replaced the auxiliary box, the up-and-down movement caused by the box motion, and the lateral movement caused by the box motion and guided by the finger *H*. The running box has but an up-and-down movement, which is caused by the box motion.

Without doubt the most difficult and important change made was the substitution of the square leather picker for the raw hide picker. It is necessary to use the raw hide picker on drop box work in order that the boxes may be actuated up or down, as the case may be. We feared at first it would be as essential in this automatic loom, as the auxiliary box takes the place of the running box in order to change the shuttle, and in that respect is similar to the drop box loom; but by the adoption of the feeder for the auxiliary box we were enabled to overcome all other obstacles.

Had we been unable to accomplish this, the success of the loom would have been greatly hindered, as it would have required more floor space than the other print cloth or sheeting looms take.

Having become somewhat familiar with the mechanisms of the shuttle shifting loom, let us see what merits are to be derived from its use. It is conceded, I believe, that one weaver

can tend from four to eight ordinary looms, according to the class of goods to be woven. By the use of this mechanism one weaver can attend fourteen 28-inch looms on print cloth 64x64. This has been demonstrated several times, and at our Green Street works this number can be seen in constant operation attended by a single weaver. Some manufacturers who have seen the looms referred to in operation, believe it is possible to increase this number to sixteen, producing no bad results from the addition.

Our confidence in the ability of a weaver to do this has been greatly increased of late, for in the South one operative, but three months a weaver, ran thirteen 54-inch looms weaving goods 80x84. Although these were among the first looms sent out, we have received the most flattering reports from them.

It is possible, perhaps, to apply other devices that would make the looms more continuous running, but to do this would be to add more machinery, which would mean more loom fixing and more expert weavers. What we have tried for and what we believe we have obtained is a simple, automatic loom which can be placed upon the market at a price commensurate with the price of our other weaving machinery.

Although hesitating to place more machinery upon the loom, believing that in its simplest form the results obtained would be the best, we are applying to it an arrangement by which a plurality of shuttles may be in constant reserve. We accomplished this in the early stages of experiment, but changing the mechanism from conditional to positive motion, as I have already tried to demonstrate to you, necessitates further experiment. The broad idea will remain the same, the task being merely one of proper adjustment. We do this to meet the demand of some of our customers, but can hardly see the necessity, for, after careful observation, we have found that the operative in charge of a set of these looms returns several times to each one before it becomes necessary to place a fresh shuttle upon the feeder. If this is so, there will be no time saved in placing eight or ten shuttles in reserve when one will suffice. We believe it is as

pertinent to increase the speed of a loom running at 190 to 200 picks a minute as to burden it down with an unnecessary number of devices. We know by experience we will lose in production by too great increase in speed. Will we not also lose by the addition of too much mechanism? Our experience in weaving machinery has been that no loom can be entirely disregarded by the weaver, for a thousand and one different accidents may befall it if not under his constant observation, consequently, if by the adoption of a simple device we can successfully double the number of looms deemed practicable heretofore for one operative to attend, a great advance has been made, and to continue further we feel may cause more of a set-back than a gain.

The PRESIDENT. Gentlemen, you have heard the paper prepared by Mr. CROMPTON. We should be glad to hear from any member present on the subject or any kindred subject, or are there any questions to be asked that may be answered by those who are familiar with the loom?

Mr. EBEN S. DRAPER. I would like to ask the largest number of looms of this description made by the Crompton & Knowles Loom Works and in any mill at the present time?

The PRESIDENT. You hear the question asked by Mr. DRAPER. Can you answer it, Mr. WOODBURY?

The SECRETARY. No, I cannot.

Mr. EBEN S. DRAPER. I see Mr. WARE is here.

The PRESIDENT. Would Mr. WARE kindly give us some points; I mean the number simply?

Mr. JUSTIN A. WARE. Excuse me, Mr. President, I didn't hear the interrogatory.

Mr. EBEN S. DRAPER. I asked, Mr. PRESIDENT, for information as to the largest number of looms of this character that were now running in any one mill. There is no number stated in the paper by Mr. CROMPTON.

Mr. JUSTIN A. WARE. Fourteen.

Mr. EBEN S. DRAPER. And what mill is that?

Mr. JUSTIN A. WARE. That is in the Granby Cotton Mills, Columbia, South Carolina.

Mr. EBEN S. DRAPER. Are they running fourteen looms to a weaver there now?

Mr. JUSTIN A. WARE. That has been done, thirteen and fourteen; when one loom was disabled by accident, then the weaver ran thirteen instead of the fourteen.

Mrr EBEN S. DRAPER. How many weavers are running thirteen looms now?

Mr. JUSTIN A. WARE. I understand one weaver.

Mr. EBEN S. DRAPER. Now?

Mr. JUSTIN A. WARE. Yes.

Mr. EBEN S. DRAPER. I was there, Mr. President, two or three weeks ago, and that is why I asked this question. I found that at the particular time I was there there were two weavers running the fourteen looms. I understand that what Mr. WARE says is absolutely correct, that they did run thirteen or fourteen for some time, but that afterwards for some reason, of course what I don't know, two weavers had been put on to the fourteen looms. I was asking for information. My reason for asking this question, Mr. President, was simply to get further information if possible in regard to this statement, the very im-

portant one in this whole paper, that with the shuttle changing mechanism a weaver will be able to run fourteen looms. If that is demonstrated of course it is a very important consideration; and that was my reason for asking this question, to find out how extensively up to the present time that had been accomplished; that was all.

Mr. JUSTIN A. WARE. I would state that, as the paper intimates, any manufacturer can see at Worcester, in a small weave room that has been established, one weaver attending fourteen looms constantly on regular print cloth, but in this case in the South one loom was disabled and then the weaver attended thirteen. If two weavers have been put on the thirteen since, I am not aware of it.

Mr. WILLIAM EVANS. I would like to ask at what speed they run those fourteen looms?

Mr. JUSTIN A. WARE. We run them at various speeds, at from 175 to 185.

The PRESIDENT. That is on print cloth?

Mr. JUSTIN A. WARE. On some samples we have run as high as 200. Allow me to add further, in answer to Mr. DRAPER'S inquiry as to how many looms we have sent out, that we have not attempted to treat the matter in a large way as yet, but have sample looms and sets of looms in operation in different mills in different parts of the country, on different grades of work, some on print cloth and some on coarse grades of work. We work it into various lines to see how this automatic shuttle shifting mechanism will apply to different grades of work, and it promises remarkably well. Members will please understand that these looms operate without warp stop motions.

The PRESIDENT. Are there any questions to be asked of Mr. WARE, any points brought out in the paper or anything else in connection with this style of loom?

Mr. JOHN E. PREST. Will Mr. WARE please tell us the kind of goods those looms in the South are making, and also the production for the loom?

Mr. JUSTIN A. WARE. I have not got the figures with me just at present. It isn't a fine grade of goods at all. What we are making at the weave room, at the works, is ordinary print cloth, Fall River style.

Mr. JOHN E. PREST. What is the speed?

Mr. JUSTIN A. WARE. One hundred and sixty-five or 175; a few looms we push as high as 200.

Mr. JOHN E. PREST. What is the production, the percentage?

Mr. JUSTIN A. WARE. I have not any figures.

Mr. JOHN E. PREST. Of those at Worcester?

Mr. JUSTIN A. WARE. This weave room we have fitted up to show our manufacturers, we have not kept any correct tallies of production, etc.; but the weave room is there, and open to the inspection of any manufacturer who may please to call upon us. But the fine figures of production have not been reduced yet. I would say that the loom has caused so much attention among manufacturers that we are overwhelmed with applications to apply it, entirely beyond our capacity to meet them, in all the different grades. There is a great deal of interest excited in this matter on account of its simplicity, and there are so many different styles and kinds of looms to which they wish it applied; I should judge we had been applied to to attach it to all the different makes of looms since the flood, from the old timers clear up to the modern loom, and of course we are completely overpowered with the different styles and changes and sizes of shuttles and different kinds of looms; so that we are struggling as fast as possible to adapt it to the different styles. But they are so many in number, and so many different forms and devices that we find we cannot cover it as rapidly as we would

like. But we wish, in the end, to make this motion applicable to every grade and style of loom that is made in the country. That is what we are aiming to do. It is not only new looms that we strive to sell, but we are going to have this attachment made to apply to all, so that the cotton manufacturers can put the attachment on to their present looms and not have to shift looms.

The PRESIDENT. This is certainly a very interesting subject. I do not wish to pass from it to other papers if there are any gentlemen who desire any more information on the matter.

Mr. JOHN E. PREST. Mr. President, I understand in the Fall River mills the weavers are running twelve looms, and Mr. WARE says they are running fourteen. Now what amount of saving is he going to make in this? That is what we are anxious to know at the present time. There is the cost of changing those looms, to adopt this change and put them on to the old looms. Would you save anything after paying for cost of change?

Mr. JUSTIN A. WARE. Do I understand the gentleman to say that that is the average, one weaver operating twelve looms on print cloth?

Mr. JOHN E. PREST. No, sir, not that. They have run ten or twelve.

Mr. JUSTIN A. WARE. The average is eight, is it not?

Mr. JOHN E. PREST. Yes.

Mr. JUSTIN A. WARE. About eight, I think.

Mr. JOHN E. PREST. Poor weavers don't run quite so many, the best run more.

Mr. JUSTIN A. WARE. I thought the average would be eight in Fall River from what I have been able to learn, but I had not known of a case where twelve were running in Fall River by one weaver on the ordinary print cloth loom. There may be a case of that kind, but I have not heard of it.

The PRESIDENT. If you feel there is nothing more you want to say on the subject we will pass to the next one, a paper on "Slashing", by Mr. GEORGE TRYON of Fall River.

SLASHING.

George F. Tryon, Fall River, Mass.

In complying with a request to write a paper on this subject, let me say at the outset that it is not to air any remarkable knowledge that I think I may have, or to try to see how much can be said upon this matter without saying anything, but rather to see if from the outcome of a few thoughts expressed here at this time, that this important subject may be opened up and discussed by those present, that may be both interesting and profitable for every member.

Slashing was first introduced into this section of the country about 1870; in 1869 the U. S. Flax Company of Central Falls, R. I., a mill operated by the A. & W. Sprague Manufacturing Company sent some yarn to Lewiston, Me., to be slashed, and four warps were returned.

It required the services of four weavers and one loom-fixer most of the time to keep those looms running.

But little progress was made for one or two years after that, but in 1870 some slashing was done, and in 1872 and 1873 it began in earnest to take the place of dressing. The principal reason why there came to be a demand for this change was both on account of the difference in the cost of labor and more uniform results. Much might be said by way of comparison at this time, between dressing and slashing. I shall only mention two points.

1st. One dresser formerly would only supply warp for about 100 looms on ordinary sheetings, at a cost for labor of from $18 to $24 per week, while at the present time one slasher will supply warp for from 500 to 700 looms on same class of goods,

at a cost for labor of from $9 to $12 per week. These prices do not include the cost of a helper in either case.

2d. Uniform results. At the present time I think I speak advisedly when I say that there is not one per cent. of the soft and hard places with slashing that there formerly were with dressing, and where it required the constant attention of at least five men for every 500 looms, it now only requires one man to do the same work, a fact of itself of sufficient reason why we must surely have very much more uniform work on a slasher.

Now let us consider what the requirements are to produce the best results in the slashing department; and I wish to say at this point that on slashing as well as in all other kinds of business, good men differ and employ different methods to accomplish the same results, hence what I may say on this subject is an opinion based on the results of experience and observation of one man, and as mentioned at the beginning of this paper, I hope to bring out the opinions and ideas of the members of this Association and thereby be of mutual advancement by an interchange of thought and experience which may be for the general advantage of the whole.

Now in order to bring this matter before you in an intelligent manner I will say

1st. Good warping is an absolute necessity to the success of good slashing, and without it the best results will be impossible in the slashing department, and in order to do this it must receive skill and careful attention constantly.

2d. A good machine. On this point there will no doubt be many opinions, but in so far as my experience goes the Howard & Bullough slasher combines more good points necessary for producing first-class work than other machine I have ever seen; it is a machine that is well built and has many little conveniences in its construction for operating that are not found on other machines, everything necessary for finishing, doffing, and starting the beam, can be operated without the slasher-tender leaving the front of the machine. I do not know of a machine so conveniently arranged in these respects; the only objection that I

raise is the fact of the cut-marker doing its work in the front part of the slasher which sometimes allows the yarn to go on to the beam damp after having been marked, thus causing two or three more marks to be made on the yarn, and in this way making it convenient for the weaver to allow for bad places and otherwise; but this difficulty can be easily obviated by using three pairs of bevel gears with a half-inch shaft running from the front to back of machine and placing the marker in front of the size rolls. This device is very simple and will do the work effectively. I also note that the size rolls are heavier than of any other machine that I have seen, which have superior advantages in assisting the sizing to penetrate the yarn and at the same time act as an important feature in preparing the yarn to be properly and easily dried by the cylinder, otherwise inferior work and very unsatisfactory results follow. The weight of the rolls on the machine I have in mind are front roll about 500 pounds, back roll about 250 pounds; the cylinders are well and firmly built, and are able to stand the strain without constantly being repaired for leakages common to other machines. It is also fitted to operate with cones for driving or gear driving. My preference is for cones, owing to possible variations either in the head of steam or conditions of sizing in the box, which makes it easier to control in such cases and with less liability for bad work.

3d. A good man. Nothing can be more essential than to have a live up-to-date man to handle the machine, for it requires constant watchfulness and care. No place can be found inside the four walls of a cotton mill more important in its own detail or that requires so great care on the part of the operator as the slasher, for it is absolutely necessary in order to be a successful operator that he be able to keep the quality of his work up to the standard, exercise the strictest economy in making and handling his sizing, and in looking after waste, also at the same time to obtain the required quantity of work that the machine is capable of producing. One point I wish to make here is this, although the statement may seem incredible, it is

nevertheless a fact that with strict economy in making and handling of sizing, the difference between a first-class man and a man of ordinary ability, is more than one-half the amount of his wages, aside from the fact that greatly superior work is the result.

This being true it would seem to be good policy to sacrifice a little more in some other direction in the cost of labor rather than figure unreasonably close between an A1 man and one of those slow-gaited men who is just a little behind in these important details, where so much depends in order to produce quantity and quality in the weaving department.

4th. Good starch. On this point I realize there is a difference of opinion. It is claimed by some that corn starch does the work fully as well and costs less; personally I should be inclined to go slow with corn starch except on very light weight goods. This is more of a matter of opinion with me than experience. I have always used potato starch, and some of my experience with potato starch has not been what I could expect from a first-class article, so in my opinion it is profitable to buy the best that can be had from reliable parties.

5th. A good softener or sizing compound. On this subject much has been said and written; almost endless experiments have been made both by the manufacturers themselves and by the trade to see who could succeed in furnishing the best and most economical compound, and it has been a sort of a wild race with some of the manufacturers of compounds to see who could come out ahead. I am of the opinion that there is nothing connected with the slashing department that has received so much attention, or has been discussed more than this one subject of sizing compound, and certainly it is an important feature and has much to do with the successful sizing of yarn. There have been almost as many compounds introduced as there are mills. Three or four of these have remained on the market and have more or less merit, but many of the compounds are in my opinion of no use whatever. Various claims are made by cotton manufacturers on this subject, and it is contended by

some that no compound whatever is needed beyond possibly a little tallow; and they claim to be successful in handling their work by this method.

It may be said in this connection that everything depends almost wholly on the class of goods manufactured, a point almost wholly lost sight of by many. The proof is that while there are some compounds that are satisfactory on some kinds of goods, and others failures, there are compounds manufactured at the present time that will fill all the requirements for any class of goods, except it may be on goods where the weight is largely determined by the finishing process, which of course requires an entirely different article. I find the following advantages in using a first-class compound: no foaming in the box or souring of the sizing, the fibres of the yarn are laid smooth because the yarn does not stick to the cylinders, while should the yarn stick to the cylinders, so much more of the starch will fly off on to the floor and machinery, and in such cases it is not an uncommon thing to be called a slack sized warp when it is being woven. It also extends the life of a loom harness, breaks less yarn in process of weaving, makes a better looking face on the goods, and presents a better appearance for market.

6th. Sizing properly made. Much depends upon the making and the proper cooking of the sizing, and as on other points many differ as to methods, so on this one some claim that it is just as well to dump all the ingredients into a tank of cold water as it is to mix thoroughly and put into the tank after the water has been warmed. I prefer the latter plan; after mixing bring to a boil and cook till it is ready for use, the length of time for cooking depending on the kind and quality of starch used. To my mind this is one of the important points and should be carefully looked after if good results from the slashing and satisfactory production from the weaving is expected.

7th. Sizing properly boiled in the box. As a rule very little attention is given to this part of the business beyond keeping the sizing warm or letting it boil over upon the yarn. But with

this as with other features in slashing, I believe that it should receive the careful attention of the operator. It is customary for some slasher men to only keep the sizing warm in the box when the machine is in operation, but the majority let it boil in a haphazard sort of a way, not giving it much attention anyway, but letting it boil in almost any form, only see that it does not boil over. In my estimation here is a place where the skill and judgment of the operator is demonstrated to as great advantage as in any part of the whole business, both in economy and general results which has its direct effect on both slashing and weaving. Here is the place where the operator can waste or save, and I believe that a great many of the slasher tenders of the present day almost lose sight of the importance that this part of the business demands.

There is another feature here in this connection of which I shall speak.

In a mill where I was once employed I found a box about 2½ feet wide and 4 feet long, under the size tank, with a pipe leading from the tank to it, and the sizing was drawn into this box after having been sufficiently cooked. There was also a small pump with a pipe leading to the size box and an overflow pipe back to the box. The pump was kept in constant motion, and when it was not pumping into the size box of the slasher, the sizing was passing through the overflow pipe back to the box again, thus keeping the sizing in constant agitation. Not being accustomed to such an arrangement I did not look upon it with much favor at first, but later on, as I continued to use it, I became convinced that for keeping the sizing of one consistency all the time it was a grand success, and I am of the opinion that better results can be obtained from the same amount of starch by this system than by any other method I have ever seen.

8th. Good material for roller covers. This point is not always regarded to be of very much importance.

Almost anything, in fact, in some instances is thought to be good enough to answer the purpose, and the material for roll

covers is in use from coarse cotton and wool 20-ounce blanket down to common sheeting for one roll. In the opinion of the writer, the best covers for slasher rolls is an all wool 16-ounce blanket for the back roll and a plain weave all wool 12-ounce blanket for the front roll, both blankets being an open weave so as to retain or eject the sizing; the office of the roller cover being to assist in penetrating the yarn with the sizing, and after the yarn passes the front roll there should be very little sizing on the outside of the yarn. This condition can only be obtained by the right weight of rolls, the right kind of covers, and the rolls kept in order, and then only by the sizing in the box being of the right consistency and properly boiled. I believe it to be very essential to the success of good slashing to be very particular in the selection of roller cloths, and once the right grade is secured never change because you may be able to buy for half cent per yard cheaper, or for some other similar reason, for it does not pay to buy a cheap grade of cloth.

9th. Proper head of steam. As we are all aware, a great deal depends on the distance the steam has to travel and whether it is a direct pipe from the boilers, or a branch, as to the ability of the steam to heat the cylinder sufficiently to dry the yarn. I have used both direct and exhaust steam from 2½ pounds pressure to 10 pounds. I find that about 6 to 8 pounds pressure of good live steam is preferable both for drying and for safety. Always under all circumstances take extra precautions to know that the water is kept clear from the cylinders, for the best good of the machine and best results in drying the yarn.

10th. Proper leasing. It is a mistaken idea that because of good warping it is not necessary to occasionally put in the lease strings, for no matter how good the warping may be, or how few threads may break on the section beams, the lease should be taken five or six times per day, as there are always more or less breakages of yarn in the front of the machine, caused by sticking together behind the rods, etc. Again the lease should always be taken and comb picked out at the beginning of the beam, in order to keep the yarn straight for weaving.

11th. Tension. In closing I wish to especially emphasize the fact of the necessity of winding the yarn on to the beam in such a manner as to preserve its elasticity and thereby produce good results in the weaving. I believe it to be impossible to produce as good results with the beam as hard as a rock as can be produced by having the beam so that it will yield a little when the hand is pressed against it. This point is particularly noticeable in the weaving when the yarn is a little weak, or possibly finer than usual. There is much more that might be said on the various phases of this subject, but I shall stop at this point, hoping to hear the opinions of others at this or some future meeting.

The PRESIDENT. Gentlemen, we have heard with interest this paper of Mr. TRYON. We should be glad to hear from any member here in regard to the question, or any statement of their experience, etc.

Mr. EDWARD ATKINSON. Mr. President, I didn't know this subject was coming up; perhaps you will get too much Atkinson if you don't look out. I happened to import the first two slashers that ever came to this country. When Mr. AMOS D. LOCKWOOD was the adviser of the Lewiston and Biddeford Mills he was about to go to Europe to study the conditions of English manufacture. The last day that he came to the office I said to him, "Mr. LOCKWOOD, they are 25 years ahead of us in sizing warps; I don't know how they do it, nor do we want to learn the art of loading warps; but I wish that your first business would be to find out what machines they use for regular work in sizing." He took the case up immediately, wrote home about the slasher, and we immediately ordered one for the Continental Mills and one for the Indian Orchard Mills. They were put in

and the revolution was accomplished. It comes nearer to an absolute revolution than anything else that I have witnessed in my fifty years of study. All our other developments have been by detail. This was a revolutionary change.

Now, I always have a theory to present. I have presented it once before, many years ago. I am told that the important point in dealing with the fibres either of cotton or of wool, but especially of wool, is to keep the heat applied down below a point at which the fibre becomes brittle. I believe that point in wool is about 120 degrees Fahrenheit, but what it is in cotton I don't think any one really knows. There is a point, we all know, at which yarn becomes brittle, but that point is not established. It is, however, true, as I believe that the colder you can get the substance which is to be dried the less the requirement of temperature to dry it but perhaps the longer the time. The lower the temperature the less injury to the fibre and the more elastic may the yarn become. I believe these are fundamental principles. Some time ago I suggested that at mills on canals a stock of ice should be secured in winter to be used as a cooler of the yarn as it emerges from the size box saturated with boiling size, to the end that before the drying operation should be applied the temperature of the yarn, with its water in it, should be reduced to the lowest possible point. And if you will look back in your old records you will find a record of the capacity of air to take up moisture in ratio to its temperature.

Now then, a new force has lately been developed of which we have yet no knowledge,—liquid air. Liquid air is produced by compression or condensation. The volume of air is reduced in volume from 700 to 1 or thereabouts, and the temperature of liquid air is 320 degrees below zero. One of the latest experiments that has been tried, related to me by a witness, was the application of liquid air to mercury. A block of hard pine, with a slot of an inch section, 12 inches long, was placed on the table. That slot was filled with mercury and liquid air was then poured over the mercury. The frozen mercury was then taken out and used as a hammer with which to drive a nail into the

hard pine. How far that new development or new form of energy may go, none of us can yet imagine, but it brought instantly to my mind a suggestion which I made, and which I now put before you, for whatever it may be worth as a pure theory. Compression may be readily applied in any mill to a large volume of air. When that volume of air is suddenly released, it reduces temperature very rapidly. Now then, may we not compress air, pass your sizing directly from the size box, filled with water and hot size, through a chamber in which you can release compressed air, and thus reduce its temperature to a given point, just above freezing, a matter which will depend wholly upon the power required, a measurable quantity? you may then pass that yarn to your drying apparatus, and it would seem probable that you would immediately dry it with less expenditure of heat, and with much greater elasticity than you now get when you apply the drying process to yarn that is already nearly to the boiling point. I think I will make a model and file a caveat for the claim to a patent on this so as to make it an object for some one to take this matter up. It happens that, being nearly the Nestor of this Association, I have had this matter in mind since 1866, when we imported the two first slashers that were brought to this country.

Do not understand me to propose to put wet yarn through a chamber in which air is under compression. The compression of air generates heat. When compressed air is released suddenly it generates a corresponding degree of cold. My conception is that a box containing a pair of squeeze rolls shall be placed between the size trough from which the hot yarn emerges and the next stage in the treatment of the yarn. Opposite the end of that box or chamber I propose to put an air compressor, from which I may release the compressed air, generating a low temperature as the yarn passes through the box.

Since this subject was presented at the meeting I have consulted several scientists, putting to them the following question: Assuming that a given quantity of yarn which had been saturated in boiling size can be reduced in temperature to 32 degrees

Fahrenheit and may then be subjected either on a cylinder or in a hot air chamber to direct heat from the cylinder or to a current of warm air at 150 degrees Fahrenheit, will that yarn be dried more rapidly or less rapidly than if taken directly from the size box, say at a temperature of 200 degrees Fahrenheit and then carried to a cylinder or hot box heated to 300 degrees? I can get no satisfactory reply to this question. The answer is that it is not a simple but a complex problem. The effect of the starch is to be considered. No theory can be given which would answer the problem, only experiment. I fixed the proposed temperature to which the cold yarn should be subjected to 150 degrees, with the fact in view that the very rapid evaporation of moisture would tend to keep the yarn cool and that under that condition the temperature of the yarn itself would not be raised above 120 degrees even if to that point.

Mr. JOHN ECCLES. Mr. President, I would like to say a word on this matter, which to me is a very important one, the slasher. There are a great many things about slashers that we would all be interested in, I am sure. One of the things that Mr. TRYON mentioned was good warping. I have found that section beams should be of even weight and balanced true. A section beam out of balance requires more weight to regulate it, and the excess of weight makes waste. Another thing is that when you draw your yarn very tight through the size box it it does not seem to me that it ought to absorb the same amount of size as it would when run through with less tension. It sizes better in proportion. Good warping section beams should be free from ridges or high and low places. Sometimes I find we have trouble in that way; it is pretty hard to get it just right when running light goods, and particularly when the yarn is fine. There is no good reason for yarn breaking on section beams, or between section and size box, if the tension is uniform and the ends properly mended on the warper.

Mr. TRYON also spoke with approval of the cone driver. That is not our experience. We like the positive gear driver

best. The cone driver is liable to slip and I think is liable to make more poor work. We have tried both kinds; we now have positive gear motion and like it very much better. It is less liable to slip and cause bad results.

What is the proper length of time, I would like to ask Mr. TRYON, for cooking starch, to tell when it is properly cooked?

Mr. GEORGE F. TRYON. I will answer that question by saying it is an impossibility to give a correct answer to it, owing to the difference in starch and other conditions. The only answer that can be given is to cook starch until it arrives at the point where it is done.

Mr. JOHN ECCLES. That is one of the things you can hardly tell. We have a way of taking up the size and examining it, holding it up and seeing how long it will hang, and in that way it shows whether it has got the right qualities to it. I would like to ask also the length of the slasher cloth, about how long? He spoke of having two different kinds of slasher cloth, one for the front and one for the back.

Mr. GEORGE F. TRYON. Three to four weeks, I should say.

Mr. JOHN ECCLES. I mean, how long is the cloth?

Mr. GEORGE F. TRYON. About four yards.

Mr. JOHN ECCLES. Five yards?

Mr. GEORGE F. TRYON. Four or five yards of the twelve ounce, and about three and a half to four yards of the sixteen ounce.

Mr. JOHN ECCLES. I would also like to ask if he found any benefit from taking off a slasher cloth after it has been on a certain stated time, washing it, and winding it back, or let the slasher cloth stay on the roll until worn out?

Mr. GEORGE F. TRYON. I don't think there is very much to be gained in regard to that. The old idea used to be that it required taking off about once or twice a week. But in doing

that, and the reaction taking place from getting the cloth back again to its original position, we missed more than we gained; so that leaving the cloth on the roll, and occasionally rolling it off to soften it up, is in my opinion the best principle to go by.

Mr. JOHN ECCLES. I have no doubt that some of the gentlemen here are better versed in slashing than I am myself, and I would like to hear from some of them. I think it is one of the most important things today that we have got to consider, the sizing of yarn. These people who have got great secrets keep them to themselves; I haven't got any. Speaking of the different kinds of preparations for sizing, etc., in talking with Mr. MESSENGER coming up on the train, he rather astonished me by saying that he was using none whatever with the best success. Perhaps Mr. MESSENGER would speak of his experience in slashing, of what he has found in using none whatever, simply pure starch and tallow, with the best of results.

Mr. FRANK M. MESSENGER. I will say, Mr. President, that we undertook to do something with modern improvements in sizing compound, and tried one thing after another until we got so disgusted with the whole business that we almost resolved to set a guard at the door against sizing compound men. But some of them were pretty good fellows, we were well acquainted with them, and were finally induced to try again, and on different occasions we have taken up different compounds, some of which have worked very well. We have recently used a compound for a year and a half in our upper and larger mill, where we change and have a good many different styles and weights of goods with very good success. When we first started we found a little saving in cost with equally good results; but I don't know how it came about; that saving seemed to fade out until we woke up to the fact that it was costing us a little more than it did to use plain tallow. I suggested the matter to our overseer of weaving, who also has charge of the slashing, and I found that he would be very agreeable to using tallow again, as we had formerly done, and as we are doing at the lower village

on our heavier work, and we have gone back to the old-fashioned idea of using a little tallow with our sizing, using no compound whatever. We have not found in the very many different kinds we have used, the advantage of using compounds over using tallow. Perhaps there is one little advantage that we found with some of the best compounds. I think that the cylinders and coppers are a little cleaner than they are with the old method of using clear starch and tallow. But as to the uniformity of our warps in general, the smoothness of our yarn, the weaving qualities and everything, we find that we get as good results with plain tallow, (using a good quality of tallow,) as we get with any compound, and on the whole we like it better. I wanted to ask one question of Mr. TRYON, or anyone else here today in regard to the weight of section beams. In most mills, we are using larger section beams than we used to. In one mill where we weave plain sheeting, when we remodeled the mill we undertook to save in the expense of warping, spooling, etc., and where we formerly used eight beams of 400 ends on a beam, No. 29 yarn, 27,000 yards in length, we reduced the ends to 320 and put on 39,000 yards, and ran ten section beams in the slashers. The result was that we had to heavy up on our warp yarns about half a number. From 28½ we had to run down to 28 yarn, and we had to make our filling a little heavier. Increasing the size of spools and the number of beams in a set was the only change that was made that would account for the change we were obliged to make in the yarns to bring our cloth at the right weight. Now, that immediately suggested that it was a bad thing to do, if we were taking so much stretch out of the yarn. But with the southern mills staring us in the face, realizing a little saving in labor cost, we held our breath and worked along with it, and we do not perceive any disadvantage in the weave room. On the contrary, we are weaving more per loom per day on these goods than we ever wove before, not owing to this but attributable to other causes, the larger production, how-

ever, indicating that it does no harm. I should think on fine work it would. It must necessarily be an injury to the yarn, and it would seem that it would be an injury even to the yarns as coarse as No. 28 warp, but the facts in the weaving do not bear it out. I would like to ask if anyone has had similar experience in increasing the weight of yarn that is drawn in the slasher, and whether they have noticed any such results as we have noticed in our experience?

The PRESIDENT. Will anyone say anything on the point raised by Mr. MESSENGER? Mr. DANA, I saw some gentlemen looking towards you for some points on slashing.

Mr. WOODBURY K. DANA. In running the slasher I have had some difficulties, and I will mention two of them and how we have gotten over these troubles. My first trouble arose in this way. One of my customers wanted me to make him 30 yarn with about 900 ends on a beam, and I found when I started the slasher some of the ends would break, there were not enough of them to readily turn the slasher, and we had to work quite slowly in order not to have them break. Now we got over this by putting a shaft parallel with the side shaft and even with the centre of the slasher cylinder, and on the side shaft and this parallel shaft we had á pulley, on each of them we had a pulley, and these two pulleys were connected with a loose belt, but that belt had a binder on it that we could readily tighten or loosen, and it was arranged so that by tightening it all the strain was taken off the yarn, and the cylinders were turned by this belt, or the main cylinder was. On the end of the shaft, I should say, there was a pinion playing into a gear, that was fastened on to the side and centre of large cylinder. This mode of turning the cylinder I have used some ten or twelve years, and it has never given us any trouble. I am in hopes that it will pass into the hands of George Draper & Sons, and that they will be more successful than I in introducing it. I believe that only two of them have been used by other parties.

Now this helps me in another way, and I will explain that in speaking of the second trouble I have had with the slasher. A man wanted me to put 700 ends on to a 30-inch beam, and in contracting the yarn from a 50-inch or a 54-inch beam on to a 30-inch beam, it was very hard to get the selvage uniform; and after studying on it for some time [the man who ran the slasher — and I should say that the other invention was not mine; it was made by JOHN WATT who worked for me, as was also the second one] in place of running the slasher and trying to contract from a 50-inch beam down on to a 30-inch beam, we put two beams in echelon in front of the slasher. The second beam was turned by a shaft running in front of the other one. That second shaft was driven by gears, or by a chain gear, and we ran the two beams, putting on each of them 700 ends, and then of course they were as wide or wider than the warper beams and we had very little trouble in contracting the selvages. We were enabled to run it faster than we would on one beam, and got more than twice as much, for we were running two beams where we had run one, and running it faster than we did before. I only used the ordinary comb when I filled these two beams, dividing the yarn in the centre of the beams. Of course when we put in new beams we had a good deal of trouble in adjusting the new beams one way and another; they were not both the same width with the comb and we could not widen or contract the comb to correspond with the width of the beams. So where we had one comb, we put two combs, each of them, of course, only occupying half of the space of the slasher. Now with these we were enabled to fill two beams at the same time. I saw recently a case where I thought these would be a very great help to a man. He was making cheese cloth, and that, I believe, only has half the number of ends that print cloth has, and it was pretty hard work for him to turn his slasher with his yarn, and of course he wasn't getting off a great deal of work to his slasher, there being so few ends. If he had this second invention that I speak of, he could run double the number of ends at the same time on his slasher, and he could run it fully

as fast or faster, and fill two beams where he has one. I think that I have saved, having this last invention on my slasher, the worth of one man, or one man did twice as much work as he did before that.

I have found that the inventions of this JOHN WATT have practically been of great assistance to me. Another thing in connection with it is, that if we do not want to get off much work we can run the slasher slower. I think it is a great help sizing yarn to run it slowly through the size. It gives the size time to penetrate it. We know that warps sized in chain are a great deal better than warps sized on the slasher. I think it is because it has time, being sized in the chain, to have the yarn thoroughly penetrated with the size, and if you want to have this arrangement and run your slasher slower, get off more work than you do now, the yarns will weave better on account of having more size in the warp than they do where they run them so quickly through your size box.

Mr. O. B. PARKER. I think the paper of Mr. TRYON'S is on a very important subject, and I consider it a very good paper. He mentions the fact that he likes the Howard & Bullough slasher better than any he has seen, and I have simply risen to say that the Lowell Machine Shop have recently furnished a slasher combining, I think, all of the points of excellence that he has mentioned regarding the Howard & Bullough. They have arrangements by which the operator can operate the slasher at the beam end. They have put on a cone arrangement which I think is better than any I have seen, and they have also embodied a feature in the cylinder bearings which I hope will be a great improvement. Probably all of you know that cylinder bearings wear considerably and give considerable trouble on that account. They are fitting up this bearing with a roller bearing to run in oil, and that oil is a cylinder oil, or heavy enough to stand the heat of the pipe. I think that will be a great improvement.

Regarding the use of corn starch, we have used both, and

have had considerable experience with both, and on the kinds of goods that we have used it, I think I may say that I cannot tell which is the better of the two. I think we can get as good production from corn starch as we can from potato. I shall have to say, in that connection, that the men who use the warps in most cases do not agree with me, but I never have been able to discover any diminution in product after we had got well on to the use of either one, either corn starch or potato.

I think that Mr. MESSENGER might speak of an interesting method of taking the air from his slasher room, and one which I think is somewhat of a revolution in taking care of the air from a slasher. I have had occasion to look into it considerably of late and have concluded to adopt that way. It is a system of galvanized covers, not as large as the old wooden cover which you usually see over slasher cylinders, but a small hood connected with pipes running to a blower or exhaust. I believe that you accomplish some of the result that Mr. ATKINSON has alluded to, giving fresh dry air and cooler air, and bringing it in connection with the yarn in a better way than the old method. I think that we should like to hear what Mr. MESSENGER should say on that point, if he cannot dry his yarn better now than he formerly could with the old method of hooding the slasher?

Mr. FRANK M. MESSENGER. I will say in answer to that, Mr. President, that there were one or two other changes in connection with it, so that I am unable to say how much credit is due to that system of hooding. The facts are, that Mr. SHELDON and myself, in looking the matter over, decided that we would need three slashers in one mill, and five in the other to do our work. We have never used the three in the first mill, only two, and have taken the third one out and stored it; and in the other mill we were in season to find out that we did not need the fifth slasher and so never put it in. We use this hooding arrangement with a very much increased product. At the time of our changes we put on this roll attachment, which the Lowell Machine Shop have adopted, which carries the yarn further

around the cylinders, running it up over a pair of rolls and back, so that we get more drying surface than we did before. I haven't any doubt that this system of hooding is superior in drying qualities to the old-fashioned idea of carrying the hood clear down to the frame. It is not an idea that is original with us. I understood that some two or three had been put in by the Sturtevant people previous to our adopting it. The Sturtevants didn't know enough about it at the time to recommend it, and didn't know whether it was better or not, but we were impressed with the idea and put it in. It is, as Mr. PARKER says, just a small hood on the large cylinder, covers a space of perhaps three feet, the whole width of the cylinder. There is no hood over the small cylinder. There is a hood over the steam box. These are connected to a main pipe, and the steam taken away by a Sturtevant fan and exhausted outside. An objection has been raised to this that the cylinders will radiate more heat into the room. To overcome this we covered the cylinder heads with an inch thick of magnesia, which is very light, so that it does not add much load to the cylinder; and we are running some fine work, without using the attachment similar to the idea that our brother here recommended, a chain attachment to drive the cylinder by power. We do not use this attachment on any goods we make, for we do not need to, although some of our slashers are equipped with it. The magnesia covering is light and does not add perceptibly to the weight of the cylinder. It saves steam and prevents largely the radiation of heat into the room.

I want to say one word which I forgot when I was up before, in regard to direct *vs.* exhaust steam for drying. I believe Mr. ATKINSON is right in his idea that there is danger of baking your yarn so that it will be brittle. We have always dried with direct steam, reduced through a reducing valve to five or six pounds pressure. At one mill we are now using steam from the receiver between the high and low pressure cylinders, and while we cannot dry quite as fast as before, we can dry sufficiently fast to do the work within bell hours and do it easily,

and I believe the warps are more elastic and the yarn is better than when dried with direct steam.

Mr. WILLIAM O. SMITH. Mr. President, I had not intended to speak on this subject or any other, but the remarks that have been brought out here are right in line with something which occurred in a mill that I was connected with five years ago. That mill was built and designed to have the slashers in the basement of the mill. Previously they had been in the upper rooms. When we put the slasher in the lower room, we found we could not keep up the production because the yarn would not dry and we were obliged to run the slasher so slowly. I had a box built to go from a hood back of the slasher. It went back to the window and we put in a Sturtevant blower there and sucked the air from the top of the slasher out doors. That was hardly satisfactory but it did a great deal better. I concluded that perhaps the air was too dead, so I ran back from under the slasher to the window and took the cool air from the window, carried it through the slasher and out again, and found we could reduce the pressure to about two pounds, and the yarn had greater elasticity and a better feel to it, and the warps wove a great deal better from that room than from the room up stairs. In connection with this, I think, as Mr. TRYON has said, a great deal depends on the man. When we first introduced Egyptian cotton, we had a great deal of trouble in getting the size to penetrate the yarn. We experimented considerably with it and finally got a size that hit it. A man from another mill came in, who had heard of our having good luck, and instead of asking through the office went down to the slasher tender, and asked him how he mixed the size. We had an old man there for a slasher tender and he was on to it all right. He said "I mix it to suit myself". So that was all he got. If he had come to the office, he probably could have found out. But I think there is a good deal in that, that he mixed it to suit his warp. We had a variety of warps. We made goods from 3½ to 25 yards

to the pound and of course he could give no rule for the size of every warp. He could not give any set rule for making his size. I just speak of this as an experience that we had some years ago.

Mr. CHANNING WHITAKER. Very satisfactory results will be obtained with either exhaust or live steam in the drying cylinders of a slasher if the opening by which the steam passes into the cylinder is of fair size; if the pipe by which steam and air leave the drying cylinder is about one inch in diameter in the horizontal portion beneath the floor which leads to the main return pipe; if a one-inch easily opening check valve is placed in that horizontal portion near its beginning; and if the main return pipe is of suitable size and delivers into a drainage water collection tank from which air can pass freely, either through a satisfactory expansion valve which will deliver air but which will not deliver steam or directly into the open air.

Mr. ROSCIUS C. NEWELL. In connection with what has been said perhaps a recent experience may be of interest.

I have never been able to see why exhaust steam, under a given pressure, should not dry just as much yarn as live steam under the same pressure. To nearly every inquiry that I have made on the subject I have received the answer that it is because of more moisture in the exhaust steam than in the live steam. I could not quite see however what that had to do with it, and when it became necessary for us to add another slasher to our equipment I made some experiments. In these experiments about two and one-half hours longer time was required to do the same work with low pressure steam than with high pressure steam; this difference amounting to more than 18 per cent. in time, while the quantity of steam consumed was only about two per cent. more, which indicated to me that the trouble was the want of inlet capacity.

I thought perhaps our piping was too small, and arranged to

have it changed. Before the work began, however, I found that the weak point appeared to be in the opening of the slasher cylinder. On visiting the Lowell Machine Shop to see what could be done to enlarge the inlet of the cylinder, I found the point of limitation resided in the holes in the inner shaft admitting the steam to the cylinder after it passes through the pipe. On returning home I had these holes reamed out, adding some new ones, and had a stuffing box made and applied to the end of the cylinder, so as to get the benefit of the full size of the cylinder openings. Improved results were immediately apparent. It may be noted in this connection that the size of inlet on the large cylinders on all slashers which I have seen is just the same as the size of the inlet on the small cylinders. This seems hardly consistent when the surface areas are considered in connection with the condensation taking place as the wet yarn is first brought in contact with the larger cylinder.

In view of these suggestions the Lowell Machine Shop have changed their patterns in building our new slasher to meet our requirements.

Mr. WOODBURY K. DANA. I was afraid I would not make myself clear, and it is evident by Mr. MESSENGER'S remarks that any slasher tender would put on a chain and gear for turning the cylinders, that I referred to, that he did n't get the right idea. I don't know as I can make it clear, but I will simply say it is way ahead of the chain and gear, as much ahead of it as the slasher is of the old-fashioned dressing frame. With the arrangement I have on my slasher there is absolutely no trouble in arranging it and no strain upon the yarn.

Mr. CHANNING WHITAKER. The Lowell Machine Shop cylinder slashers are provided with a side shaft through which the power can be caused to drive any of the revolving parts which might stretch the warp if they should be revolved by the pull of the warp. These machines are also provided with devices

connecting the side shaft with driven revolving parts by the aid of which the tension of the yarn and the consequent stretching thereof can be varied at pleasure.

Mr. S. N. BOURNE. They talk about getting steam into the cylinder, but there is another point, the getting it away from the cylinder. Of course, I don't want to bring up the Paul system, I have an idea you wouldn't like it.

The PRESIDENT. Mr. PAUL will be very much indebted to you.

Mr. S. N. BOURNE. Very well, I suppose so. Now there is one great point. While there must be a large inlet, at the same time there must be a free outlet, the steam must not be checked. Let it go down into the boiler house, it can be caught there. I see no use in holding it back. There is no need of traps or check valves.

In regard to drying with exhaust steam or low pressure steam, it may be necessary — I have found it so — to make more drying surface. I added a cylinder, making three cylinders in all, and I think it is an advantage, especially for heavy work. For light work, of course, one is not troubled about his drying surface, but heavy work, like heavy yarn with many threads, takes time to thoroughly dry and the work must be on the cylinder for some time. I maintain that there must be a large inlet to the cylinder as well as a large outlet.

The PRESIDENT. Gentlemen, we have now fifteen minutes left only for the rest of the session, in which we must take up the paper of Mr. PARKINSON'S. And here are some cloths that Mr. EDWARD ATKINSON left as he was obliged to leave the hall, and the Secretary can explain about them.

The SECRETARY. In connection with the question of weaving, which Mr. ATKINSON understood was to come up at this hour, and in further extension of his remarks on the subject of

the paper by Mr. VLADIMIR P. POLEVAY, at the Philadelphia meeting, on "Cotton Manufacturing in Russia", Mr. ATKINSON has brought here for your inspection some samples of Russian fabrics which are printed on velveteen, etc., which will be passed down and around for examination.

The PRESIDENT. We will now listen to Mr. PARKINSON'S paper.

BASTARD REED FOR COTTON WEAVING.

ARTHUR PARKINSON, 13 Gold Street, New York City.

This question is one of much importance, especially to fine goods manufacturers. This branch of the art of manufacturing has not been much commented upon by American manufacturers, and the bastard reed system, to my knowledge, is not in practice in this country. This method, however, is somewhat old in Lancashire weaving districts, and although some of our members are fairly well posted with Lancashire methods, a little discussion on this question of using bastard reeds for certain fabrics will be of benefit to the craft.

A "bastard reed" is a queer name for it, yet to my knowledge it has always been called that, and after understanding the construction of the reed, it may be acknowledged to have been the right name. It is a reed which is made with less dents on the ends than there are in the middle — about five or six inches on each end, according to the amount of contraction and the number of threads to the inch. The object of this is plain to every one who understands cloth construction, and who notices these "little matters", for in weaving, especially fine goods, or any goods requiring a great number of warp threads to the inch, a reed which has an equal number of dents to the inch all the way across, will deliver more threads a few inches on each side of the cloth than in the middle; for in weaving the cloth contracts towards the centre. Now if there are fewer dents to the inch a few inches from each end of the reed (which is called a bastard reed), the number of warp threads will be the same on the sides as in the centre of the cloth, or exactly as the goods are called for.

If an order of goods is stipulated to contain 88 threads to the inch, is there any necessity of making them 90 or 92 threads to the inch, as is the case (a few inches from each side of the cloth) when using the regular reed? Therefore it is very interesting to know why so many mills manufacturing cloth are so willing to give the buyer more than he calls for. In fact, when counting threads to the inch, I always thought it practicable to place the glass on the sides of the cloth, as well as in the centre, and count both ways. I know some manufacturers who take little notice of counting warp threads, and of course some members may be hasty in contradicting what I say on this question. Sometime ago I asked a prominent reed manufacturer if he made bastard reeds. He replied that he had never heard of anything of the kind, so I presume there are none used in the New England States.

The saving by using bastard reeds is not a small item. Say for 40-inch cloth and making goods about 90 threads to the inch, I estimate a saving of over 20 threads to each warp. Of course that will make a slight difference in the weight of the cloth, but it is easily offset by sizing a trifle heavier, say two per cent. stronger, and a little stronger size, if smooth, will make the yarn weave better.

In weaving very fine goods that call for 130 to 180 threads to the inch, a greater saving will of course be effected by using bastard reeds. This subject deserves proper attention, and some of the members can contribute much to the little I have said.

MR. JOHN ECCLES. I will say that I have known of reeds made in this way, but probably not by the particular method he means. I have known them to be made a little coarser, very close to the selvage, in order to relieve the selvages from breaking out. I can remember, some 25 years back, of this being done in Connecticut. I think I had some made once myself, where the reed was a little coarser just on the extreme selvage, to make the selvages weave better. I don't know as I ever knew it to go any farther than just near the selvage. I simply speak of this to say that such things have been done.

FOURTH SESSION.

THURSDAY AFTERNOON, APRIL 28, 1898.

The meeting was called to order at 2 P. M., President EATON in the chair.

The PRESIDENT. Gentlemen, I will say that on closing this noon we had left over, in our programme for the morning, the discussion of the topical questions. With your permission we will begin this afternoon, according to the programme for the fourth session, with Mr. Brook's paper, and when we arrive at the topical questions for the afternoon we will then take up, if we have time, such ones as the members present most desire to discuss. We will therefore give our attention now to Mr. CHRISTOPHER P. BROOKS, who will give us his paper on "Our Export Trade in Cotton Goods".

OUR EXPORT TRADE IN COTTON GOODS.

CHRISTOPHER P. BROOKS, *Director, Textile School,* Lowell, Mass.

We know of certain mills engaged for the China, Africa or South American markets, and occasionally read of shipments of cotton cloth abroad, especially from southern mills, but these are exceptions rather than the rule, and as a matter of fact, our export trade is very small. In the year 1896, and I would say that in this paper all my figures, unless otherwise specified, will refer to that year because they are the latest available ones that are complete in all respects; in 1896, we shipped out of this country to China 107,063,411 yards, to Canada 35,519,380 yards, to Africa 14,504,407 yards, to Central America and British Honduras, 11,720,035 yards, and small quantities to other countries. The whole amounted to 281,211,521 yards, valued at $16,245,077. This quantity apparently so large is small when compared with the exports of other countries; for example, the country of Turkey imported from England alone, in the year that I refer to, more than the exports of the United States to all parts of the world. In the same year, we exported raw cotton to the extent of 3,030,829,657 pounds. If we figure this as made into four yard goods, it would come to about 12,000,000,000 yards, in other words 42 times as much cotton was shipped in the raw state as would have been the case if sent out in the manufactured state.

I don't intend to take up much of your time, or give you more figures than are absolutely necessary, but will you now turn to the question of why we have not a larger export trade? It is not improbable that the reason is simply that we have not cultivated it, that we have been too busy obtaining control of

and preserving the domestic market for ourselves to remember that commercially there are other worlds to conquor. Has the time not arrived when American cotton manufacturers should consider the possibility of building up an export trade worthy of the name and the advisability of promptly making strong attempts to establish an important foreign trade for cotton goods? The question has been forced upon the trade by the addition of new mills, especially in the South, by the use of improved and higher speeded machinery, by the longer working hours of the Southern States, and other causes, resulting in a greater production of goods than the country can consume, and it is no new thing to have to periodically face the question of either allowing prices to be forced down to unremunerative rates, or to shut down, which is an unpractical and unpleasant alternative. In any case, there can be little doubt that an efficient remedy would be in an increased export trade, not neccessarily a trade obtained by robbing other countries of their established connections, nor by causing the stoppage of a single spindle or loom in the mills of competitive nations, such as Germany, England, India or France, but in the United States obtaining a share of the new business that is continually being opened up to commerce by the development of new markets. Statistics show that out of an area of land surface of the world amounting to 52,000,000 square miles, only 8,000,000 has yet been surveyed, leaving a very large amount of territorry in which we may presume that immense commercial possibilities remain undeveloped. China, for instance, has an estimated population of over 300,000,000 people. If we estimate that each individual uses six yards per year of cotton fabric, then the present imports into China, from both England and America only supply ⅓ of her needs. We have only touched a fringe of that country in our attempts at commerce, and the same applies in a still greater degree to Africa. If we refer to the cotton manufacturers of other countries, we find that they are largely employed on foreign trade. Germany, India and France, especially the two former named countries, are making rapid strides in the business of manufac-

turing cotton goods for export and Great Britain, of course, outstrips them all.

The British exports of cotton goods in 1896 averaged over 100,000,000 yards per week; they amounted to 5,218,248,600 in that year, when American exports were only 281,211,521 yards.

Not only goods but yarns form an important item of international commerce. In the year that I refer to over 250,000,000 pounds of cotton yarn was exported from Great Britain. This is reeled in skeins and made in 10 pound bundles and baled. Not only is this large amount shipped from Great Britain, but India, Germany, Holland and France enter into this international yarn trade. In this matter of export business, I have had very considerable personal experience, having for fifteen years been connected with mills almost entirely engaged in manufacturing for foreign markets, nine years of the time being spent as superintendent and selling agent in such mills.

Now to consider whether we can build up a business of this kind. Perhaps the best method of approaching this question is to face the reasons that are sometimes given as to why we cannot do so. A favorite argument is that we have not the necessary fleets of American ships to carry the goods, that the fact of having to ship them in foreign bottoms is detrimental to the business, and that foreign ship owners encourage business from the mills of their own nations. This argument is of no more value than was the argument used many years ago by German and English steel manufacturers when they said that Americans would never be able to make good knives, razors and other edged instruments, because they had not the right water to temper the metal with. The argument as to the nationality of the ship owner is an utterly unimportant one, and I do not believe that it has any detrimental effect on a possible increase of our cotton goods exports. The ship owner is in the business for what he can get out of it, that is for freight. You cannot imagine the average freight agent for a steamship line from England, Germany and France refusing to carry cotton cloth

which was manufactured in America, any more than the American Express Co. would at present refuse to take a case of olives or wine from Boston to Chicago because it was grown or produced in Spain. Another argument is that Americans cannot produce as cheaply as Europeans. While this may have been the case until a few years ago, and possibly in many cotton goods it is the fact today, yet I believe that our manufacturers can produce the plain standard fabrics, which form the greater part of the international commerce in textiles as cheaply as any other civilized nation. A high rate of wages per day does not necessarily make a high cost per pound or per yard, and although we labor under several disadvantages in higher cost of fuel, higher rate of interest on borrowed capital, and considerable higher cost for selling the mill products, and in many ways other expenses that are a heavier burden than fall to the lot of European manufacturers, still skilled management and skilled help reduce the cost per pound to a minimum.

Now let us take a few reasons as to why we ought to have an export trade. The first and undoubtedly the one reason that overshadows all others, is the fact that we are sending out of the country 3,000,000,000 pounds of raw cotton at from five to seven cents per pound, when we might ship a large portion in manufactured form at from 15 to 25 cents a pound. The balance remaining in the country as wages to help, as interest on capital and as profit to manufacturers, not only on the fabrics, but on cotton mill machinery, supplies and everything that is used in a textile factory. Another reason is that the present system of shipping cotton 3000 miles to be manufactured, and re-shipping it from 1000 to 8000 miles to be sold is a wasteful method of manufacturing and distributing goods. Not only so, but the present method of exporting the crop in its raw state necessitates the payment of a much higher rate of freight on the bulky, highly inflammable bales, than would be the cost in manufactured goods. At present, only one-third of the American crop is used in this country. Two-thirds of it is shipped to

England, Germany, France, Russia, India, Japan and other countries, there to be manufactured.

There is no limit to the size of the crop. The South could raise 20,000,000 bales just as easily as 10,000,000 if the demand existed for it, and we could supply all the other countries with the same amount of cotton as we at present send them, and yet grow a sufficient increase to use in our new export trade without any inconvenience.

I have only gone into this matter somewhat hastily, but some of the conclusions at which I have arrived as to best methods of increasing our export trade are:—

First, to improve our consular service. I do not see how it is possible for a United States Consul to be of one-tenth the service to his country in the first four years of his holding the office, as he could in the second, third or fourth term of four years. As a rule he enters upon the duties of his office entirely ignorant of the customs of the country and of the language. He is no sooner becoming acquainted with them than he is liable to be removed and another green officer put in his place. In fact, there is no encouragement for him to make himself an efficient official using every effort to help develop trade, as he knows that he is liable to be removed at the end of his first four years' service.

Secondly, I think that the expense of selling American cotton goods ought to be reduced, and in fact the whole system of handling fabrics intended for export revolutionized. Foreign orders usually come in large quantities; after the business is once established, it needs very little attention as repeat orders are the rule, and there is no reason why a very small commission indeed ought not to be satisfactory to the selling agent in this line of business. The present selling agents are not as a rule acquainted in any degree with goods intended for foreign markets, the requirements of foreigners, or the methods of handling and distributing textile manufactures abroad and thus they are naturally timid in any attempt to build up a foreign trade.

Thirdly, the assistance of banks would have to be utilized to

a much greater extent, as the credit system of selling on long time is customary in almost all foreign markets, and foreign merchants make a very great convenience of banks. In fact all their business depends on the amount of aid that the bank will render them.

Fourthly, in any attempt at building up a business of this kind it cannot be too strongly impressed that it is not sufficient to send letters offering the goods, and it is utterly useless to attempt to circularize or draw business by means of printed matter, especially if it be in the English language. We all know how prone we are to throw in the waste paper basket unopened anything that has the appearance of an advertising circular; how much more likely is the foreign merchant to do the same, especially if it be printed in a language he cannot understand.

Fifthly, we shall have to show greater willingness to make the goods that are required, and not the goods that suit our convenience to manufacture. I have frequently known mills with only two or three hundred looms engaged on export trade with 100 different kinds of cloth in process of manufacture at the same time. It is not at all infrequent in goods for repeat orders to have slight changes made in width, in length in the reed and in the numbers of the yarn, thus prohibiting the practice of putting goods into stock in anticipation of orders, and the foreign buyer is usually very determined in having goods made as he wants them, and not as the seller wants them.

I remember that our President at one of the meetings about two years ago made a very excellent proposal for appointing departmental committees to deal with and write up subjects of interest for this Association. I venture to suggest that in case this proposal is ever carried out, that no more important subject can be allotted to the attention of a special committee than "Our Export Trade in Cotton Goods".

Mr. WILLIAM S. GRANGER. It may seem arrogance on my part to offer a suggestion in regard to the remarks just made but I will say that I approve them very heartily, especially in regard to our consular service. We should follow the example of England and other foreign countries. But as for shipping, I very much take exception to the honorable gentleman. And if there is no discussion, while there is a difference of opinion, why, we apparently fall in on one track. I may be entirely wrong, but during the first administration of President Cleveland, Secretary Whitney, I think in his last message to Congress, alluded to the increase of trade facilities for Vancouver, remarked that the only way that we could compete with England is to do as she does, put on a fine line of steamships and subsidize them. As it is now, the trade before that Vancouver line was built inured largely to the benefit of San Francisco and the United States, and now it has passed largely from her to England. There is a subsidized line there now, I think about $450,000 a year. Then they have crossed the continent with the Canadian Pacific, which is very heavily subsidized, and now there is in contemplation the building of a line of steamers from Quebec to England, subsidized with $750,000 a year. What is the result? They can give a through bill of lading from China to Japan through to England over English lines. We cannot. I know also that goods are sent by export from here to South America by way of England, and if they arrive in England when a vessel is being laden, and if there is a sufficient amount of English goods to fill that steamer, what is the result? Ours are laid by until another steamer. I believe in subsidizing. If they do not want to call it subsidizing, call it paying liberally for carrying the mail.

I think that trade follows the flag. We want our own flag and we want it respected. We must have a larger navy. We must have our own line of steamers running to different sections and countries. England is bright and enterprising. You show her any land or country where she can obtain trade, there goes a line of steamers with a subsidy, and to be more expressive

than elegant, if it were to her advantage, I believe she would run a line of steamers to a hotter place than this and freight them with brimstone. I believe that we must have lines of steamers of our own, and pay liberally for carrying the mail.

The PRESIDENT. Are there any questions to be asked of Mr. BROOKS or any further discussion on this paper on the export of cotton goods?

Mr. CHRISTOPHER P. BROOKS. Judging from the English newspapers, just now there is a very great deal of dissatisfaction among English cotton manufacturers on this very point. They say that the British are subsidizing steamers between England and China and other points, and that the steamship owners are taking advantage of this subsidy to quote lower rates for American goods between New York and China by way of England, than they are giving British goods from Liverpool to China, and that is producing a great deal of dissatisfaction.

THE NICARAGUA SHIP CANAL.

GARDINER C. SIMS, Providence, R. I.

It is a pleasure to meet with you; having chosen for your entertainment a subject of mutual interest, I ask for it your earnest consideration, as we are among the largest of commercial producers of commodities, for which we desire the patronage and markets of the world. Deep interest in our immediate vicinity concerning the proposed Nicaragua ship canal has suggested the giving of a few facts by way of explanation, as well as a brief table of comparisons, time and distances, easily comprehended by persons other than geographical students.

Political and economic questions, detail of discovery, dual legislation, treaty, franchises, agreements, duplicity of foreign governments, known as diplomacy, a record of prominent persons engaged in the laudable enterprise, and scientific investigations, all belong rather to history, biography, and the realm of engineering, and do not at this moment stand paramount to the great question of immediate construction, whose object is patriotic, as well as for self-protection, independent of politics and cost, which are secondary considerations.

Nicaragua (which was discovered by Columbus in September, 1502) was originally the name of a native chief who ruled in the region of the lake when it was discovered by the Spaniards under GIL GONZALES in 1522. Possession was taken by riding his horse into the lake and drinking of its waters. The name Nicaragua soon became famous, and besides being applied to the chief and his town, was gradually given to the surrounding country and to the lake. Two years later FRANCISCO HERNANDO CORDOVA, lieutenant of the Governor DON DAVILA, who had

been appointed to his office by Charles V., with secret orders to search for the strait, was sent to take possession of the new discovery in the name of the governor. He landed at the Gulf of Nicoya, where he took to pieces one of his brigantines and caused it to be transported overland to Lake Nicaragua, where it was rebuilt. In this brigantine he made a circuit around the lake and discovered its outlet, the river Rio San Juan, which, however, he did not descend, because of its rocks and rapids. In the following year, 1523, the emperor, Charles V., in a letter to CORTEZ, enjoined him to search carefully in the eastern and western shores of New Spain for the secret of the strait. He met with disappointment, yet was desirous and continually intent upon using every means to put into execution, and carry out for advancement of the service, the wishes of his majesty.

The anxiety to discover a waterway between the oceans was not confined to Spain alone. Portugal had always been active in the quest. England had sent out the CABOTS for the same purpose. In 1523 France dispatched an expedition, and in 1834 and 1835 two others. These incidents increased the interest of Spain, but owing to internal dissentions the development of plans was finally abandoned, yet faith in this particular route was not shaken, as the historian COMARD says: "It is true that mountains bar the passes, but if there are mountains there are arms — take but the resolve and the means to do it will not be lacking; the Indies, toward which the passage will be opened, will furnish them. To a king of Spain with the riches of the Indies at his doorway, when the end to be attained is the commerce in its products, the barely possible becomes easy".

Then, for nearly two centuries, the whole subject sank into oblivion, to be again taken up in an engineering and scientific manner by Mexico, Spain, Portugal, England, France and Peru, occupying the attention of European governments.

A new factor was now to be considered in the controversy; a country that had vigorously entered into the arena of political and economic competition with the entire world, aggressive, and

whose geographical position of commanding importance gave it the superior power of dictation, namely, the United States of America. In 1825 the minister of the Central American States, all recently liberated from the despotic rule of Spain, addressed a note to the Secretary of State, calling the attention of our government to the object of uniting the Atlantic and Pacific Oceans by a canal through the republic of which he was the representative. No reply was made to the note by President MONROE, but his successor, President JOHN QUINCY ADAMS, and his Secretary of State, HENRY CLAY, replied, giving to it the consideration it deserved.

The minister in his note says: "Among the various objects which the government of the republic of the centre of America, which I have the honor to represent, has instructed me, that of promoting the opening of a canal for the communication of the Pacific and Atlantic Oceans, in the Province of Nicaragua, of the territory of that republic, has been most particularly recommended by me; and, desirous of fulfilling the high confidence which has been reposed in me, I wish to call the attention of the government of the United States of America to this interesting subject. This project, which, viewed with respect to the possibility of its execution, does not exceed ordinary bounds, is, for the importance of the effects which it ought to produce upon the general prosperity of the two worlds, the most vast which has ever been conceived; and, although the omission of it ought to fill with shame the government which previously caused it, its execution will be a most glorious act for that which undertakes and brings it to the desired termination. I am certain that my government, when placed in better circumstances than at present, could not consent to part with the least portion of this distinguished honor; but it is, in the first moments of its existence, occupied simultaneously in forming the institutions which must confirm its political government and the quantity of force which is necessary to secure its preservation; and can neither distract its attention from these objects, nor employ its resources, which are still scanty, on those which

are not of primary necessity. By the data which at present exist, there ought to be no doubt of the possibility of the work in terms shown by the plan, which I have the honor of sending you herewith. My government is disposed to employ all the means in its power to facilitate the execution; a company of respectable American merchants is ready to undertake the work as soon as it is secured by a treaty between both governments; and, finally, if a diplomatic agent be appointed by this government to the republic of the centre, and if he be instructed upon the matter, the most favorable opportunity presents itself for the arrangement of this business ".

Even at this early time the superiority of the route by Lake Nicaragua was in a measure acknowledged, as will be seen from Mr. CLAY'S reply. It is dated April 18, 1825. He says: "Your letter has been submitted to the President and attentively considered by him, and I am instructed to make known to you the very great sensibility with which he receives the expression of sentiments of consideration and friendship towards the United States, which are entertained by the government of the republic of the centre of America, and at the same time assure you that they are most cordially reciprocated. The confidence of your government in that of the United States is strongly manifested by the highly important propositions which your note communicates. That proposition is that the United States shall cooperate with the republic of the centre in promoting the opening of a canal through the Province of Nicaragua, to unite the Atlantic Ocean to that of the Pacific, and that, by means of a treaty, the advantages of that canal may be perpetually secured to the two nations.

"The idea has long been conceived of uniting the two oceans by a canal navigation. The execution of it will form a great epoch in the commercial affairs of the world. The practicability of it can be scarcely doubted. Various lines for the proposed canal have been suggested, and have divided public opinion. The evidence, tending to show the superiority of the advantages

of that which would traverse the Province of Nicaragua, seem to have nearly settled the question in favor of that route. Still on a project of such magnitude it is necessary to proceed with the greatest caution. A false step, taken in the first moment, might lead to the most mischievous consequences. The President has, therefore, determined to instruct the Minister of the United States, whom he has just appointed (and who will shortly proceed on his mission to the republic of the centre), to investigate with the greatest care the facilities with which the route through the Province of Nicaragua offers, and to remit the information which he may acquire to the United States. Should it confirm the preference which it is believed the route possesses it will then be necessary to consult Congress as to the nature and extent of the co-operation which shall be given towards the completion of the great work. The Minister of the United States shall be officially directed to assure your government of the deep interest which is taken by that of the United States in the execution of an undertaking which is so highly calculated to diffuse an extensive influence on the affairs of mankind, and to express to it also the acknowledgments which are justly due to the friendly overture of which you have been the organ. I pray you to receive assurance of my highest and most respectful consideration."

On the 10th of February, 1826, Mr. CLAY, in compliance with the promise given in the letter quoted, instructed Mr. WILLIAMS, then Minister in Central America, to make the required investigation, and from the correspondence it will appear that the business was seriously considered by our government at the very outset. Mr. WILLIAMS appears to have attended promptly to the duties assigned him, and it may be that the interest manifested by the United States expedited the result. On the 16th of June, 1826, a contract was entered into between the Central American government and Mr. A. H. PALMER of New York, for the construction of a canal through Nicaragua with a capacity "for vessels of the largest burden possible". With

Mr. PALMER was associated Governor DE WITT CLINTON of New York, builder of the Erie Canal, STEPHEN VAN RENSSELAER of New York, MONROE ROBINSON, Bank of the United States, EDWARD FORSYTH, Louisiana, C. J. CATLETT, District of Columbia, and many others. Their surveys and estimates were at fault, for they proposed to do the work with a capital of only $5,000,000. Their scheme failed because of their inability to raise the amount proposed, but the merits of the project were so evident that the King of the Netherlands, on his individual account, sent his representative to Nicaragua with full power to treat with the Central American government, but without success, owing to disturbed political affairs. During the twenty-four years that followed but little by way of practical advancement was made.

Frequent comparisons were made of the Panama and Nicaragua routes since the surveys of the latter for Commodore VANDERBILT, and his associates of the then existing Transit Company by Colonel O. W. CHILDS of Philadelphia, a distinguished officer of the United States army. His studies fully conformed to the requirements of engineering science, and are remarkable for their accuracy. This was in 1850, 1851 and 1852, and has contributed the basis of all subsequent investigations, and is still a valuable source of original information not elsewhere found, evincing the thoroughness with which his work was done.

In the month of October, 1870, a small sized steamer having a draught of ten feet, left New York on a southern voyage, and after about thirty days was anchored in Lake Nicaragua within eleven miles of the Pacific Ocean. At an elevation forty-one feet from the steamer's dock was the summit of the divide, and from it could be seen the spars of a vessel at anchor in Brito Harbor, the western terminus of the canal.

In 1872 a United States government expedition was fitted out for the re-examination of the Childs' route. The final report of the exploration, including location and estimates for a canal, were made under date of December 1, 1843, by Commander LULL, U. S. N., with whom was associated as chief civil engi-

neer, Mr. H. G. MENOCAL, the present chief engineer of the canal company.

In 1885 Mr. MENOCAL, under government direction, made a partial re-examination and re-location, and the results are given in his report of November of that year.

Under the direction of the canal company eight survey parties were employed, from December, 1887, to June, 1888, when the number was reduced to two or three. A still larger force worked from the spring of 1889 to the summer of 1890, when the parties were gradually dispensed with, and the last one withdrawn in 1891.

Quite recently the United States government commissioned and dispatched another expedition, commanded by Rear Admiral JOHN G. WALKER, U. S. N., assisted by Civil Engineer A. G. MENOCAL, U. S. N., as formerly selected by the government on each occasion, either directly or indirectly, and his labors have not only been that of engineer, but of negotiator and diplomat. His work in these fields, and the manner in which it was so well performed, marks him as a man of great ability. A Cuban by birth, he was admirably fitted for a mission which required intimate knowledge of the Spanish language in dealing with the authorities. His final report will exhaust the subject and will be awaited with deep interest.

Investigating the Inter-Oceanic Canal project fails to find the first well grounded objection to the Nicaragua route. I firmly believe the people of our country are convinced of its practicability. I also believe they endorse the Monroe Doctrine, and that the American people are determined to hold, rule and govern this continent for themselves.

To the promoters of the present Nicaragua Canal Construction Company, under a government charter of 1890, much credit is due. They have given liberally of their time and treasure, amounting to over $6,000,000, in advancing preliminary work, by way of exhaustive surveys, under direction of competent and reliable engineers of well known reputation. Excavation, docks and a fully equipped railway eleven miles in

length, running west from Greytown. Their work has been rigidly inspected as agreed by prominent Nicaraguan officials and pronounced satisfactory. It was, however, suspended in 1893, owing to the financial panic; yet a definite location of the canal route has been made. The data accumulated by extensive cross sectioning and careful subterranean explorations with the diamond drill, maps, profiles and plans based thereon, are complete and of great value. At Greytown 1,000 feet of breakwater has been constructed, and a practical demonstration has been secured thereby of the efficiency of the plan proposed for the restoration of the harbor (whenever the breakwater shall be extended to the limit required).

There have been constructed at Greytown wharves and warehouses, with proper landing facilities, permanent buildings for officers' quarters, storehouses and workshops, equipped with tools and machinery. A valuable and powerful dredging plant, consisting of dredges, tug boats, lighters, launches and all necessary accessories, has been acquired. The Pellas franchise (machines, five steamers and other material) for exclusive navigation of the San Juan River and Lake Nicaragua has been purchased. Nearly one mile of canal, 17 feet deep and from 100 to 230 feet in width, has been excavated. The survey and location of the line for all the railway requisite for the completion of the work has been completed. Sixty miles of telegraph line, providing communication with all points where work may be in progress, have been built, and the canal line for a distance of 20 miles has been cleared of timber and careful explorations have been made of all the sites proposed for the location of the locks and of the large dams.

All of the work accomplished was intended for permanent construction, hoping for a continuation and completion by our government, and *not* with foreign capital freely offered to the construction company. Five years of inactivity, and without protection of any kind, has very materially reduced the values of portable property; not so, however, of the enterprise.

Unqualified endorsement has been given by many members

of Congress, representing commercial constituents of large interests, ever ready to pass favorable judgment on broad questions of public welfare, possibly none more so than Hon. JOHN SHERMAN in *The Forum*, March, 1891, who says: "No other measure of public policy now submitted to the people of the United States, is of such wide-reaching importance as the proposed construction of the Nicaragua Canal, and it is the duty of the organs of public opinion to state the elements of the problem that it offers, so that their readers may intelligently judge whether the United States should aid in its execution, and, if so, to what extent and in what manner. In the treaty of December 1, 1884, between the United States and the republic of Nicaragua, is a provision for the construction by the United States of an inter-oceanic canal from the Atlantic to the Pacific, across the territory of that republic. It was sent to the Senate on December 10, 1884, accompanied by a message from President ARTHUR recommending its ratification in strong and earnest language".

The Panama railway, 46½ miles in length, was commenced in 1850, and the loss of life in its construction is said to be represented in numbers by every railway cross-tie laid. Not so with the Nicaragua Canal for favorable and obvious reasons.

Lake Nicaragua, a body of fresh water large enough to easily accommodate and float the entire navies of the world, would be of great advantage in this particular, as ocean-going vessels are almost immediately relieved of barnacles and accumulations of fouling-growth as soon as entering fresh water, thus in a measure saving dry dock expenses.

The area of Nicaragua is 49,000 square miles, equal to the areas of the States of New York and Rhode Island, 48,705 square miles. The surface area of Lake Nicaragua is 2,600 square miles, while that of Long Island Sound is less than one-half, 1,200 square miles. In 1890 the population of Nicaragua was 360,000, while that of Washington and Providence was 362,538, and the State of New Hampshire was 376,530. The length of Lake Nicaragua and Long Island Sound is 110 miles

each, while the maximum width of the former is 40 miles, and of the latter 20 miles. Lake Ontario is 170 miles long with a maximum width of 40 miles. The length of the Nicaragua route from ocean to ocean is 169.5 miles, while from Wickford Junction, R. I., by way of N. Y., N. H. & H. R. R. to New York is 170 miles. The length of canal in excavation is 26.8 miles, while the distance from Boston to Lowell, or from Providence to Newport, is 26 miles. Length of the San Juan River is 64.5 miles, and from Providence to New London is 64 miles.

The annual capacity of the proposed canal will be 20,000,000 tons with single locks, which could be doubled should occasion require, thus bringing us into close communication with 500,000,000 people almost unknown to our country in a commercial sense.

The distance from New York to San Francisco, as usually followed by sailing ships around Cape Horn, is 14,840 miles, via Nicaragua Canal 4,760 miles, a saving of 10,080 miles. The saving from New Orleans is 11,005 miles, and from Liverpool is 7,182 miles. The saving in time will be 25 days.

The good ship Peruvian, since wrecked on Cape Cod, was in 1859 about 42 days weathering Cape Horn, having been blown back three times.

In 1851 the clipper ship Flying Cloud of Boston, sailed from New York to San Francisco in 89 days and 18 hours. Clipper ship Flying Dutchman in 1852 sailed from New York to San Francisco, discharged and loaded, wharf to wharf, 27,220 miles, in 6 months and 21 days.

In 1853 the half clipper ship Contest made the New York and San Francisco voyage in 79 days; the Trade Wind in 1853 in 75 days; the Andrew Jackson in 1860, 80 days and 4 hours, and in 1870 the Young America in 82 days and 6 hours.

These sailing records are remarkable and exceptional, and by good seamanship on the Flying Cloud the distance sailed was but 13,610 miles.

The saving of over 10,000 miles of travel, or 66⅔ per cent. of total distance, will result in a proportionate saving of invest-

ment by way of freight transportation, insurance, interest and time, as well as escaping the dangers of Cape Horn, all these being important considerations.

These facts appeal to the manufacturers of New England, and they should familiarize themselves with this great subject as an additional avenue for the distribution of their products.

Strictly speaking, there are but four manufacturing countries, yet it will be well to realize we have the fifth, Japan, with its 40,000,000 of people, about to enter for competition and division of profits. Her labor, imitative, almost unlimited, instinctively skilled, free from trade unions and legislative incumberance, will indeed be cheaply obtained, until civilization in a measure advances them to our present conditions.

We should, by geographical location, have the trade of South America, and hold it against this new, and all competitors. It cannot, however, be accomplished without the most favorable of conditions, and it is within the power of our country to possess them, without the aid of foreign capital, which is now ready and willing to complete the canal enterprise. Recent international events, however, preclude its employment in this enterprise.

A few years since, when exaggerated complications arose between Chili and our government, aided and encouraged then as now by that unreliable and for our country unfortunate jingo element, always and ever ready with words, to "stand by the old flag" (with words only), what a satisfactory feeling of relief would have possessed us if our White Squadron could have passed through a ship canal to Valparaiso, saving a distance of 5,062 miles, and, figuratively speaking, concentrated with "Quaker guns" for a "moral demonstration", and may our merchant ships follow with cargoes for an exchange of valuable productions.

The ship canal with three locks at each end, each 650 feet long, 80 feet wide, 28 feet deep and lift of 45 feet, will accommodate our largest ocean steamers, as will be understood from the following dimensions:

	Etruria and Umbria.	City of New York and City of Paris.	Teutonic and Majestic.
Length,	501.6	565	582
Breadth,	57.2	63.2	57.5
Depth hold,	38.2	42	39.2
Draught,	27	27	27

The Sault Ste. Marie lock, 515 feet long, 80 feet wide and 17 feet deep, was the largest in the world, and the proposed lock of 50 per cent. added superficial area, may possibly be completed in the near future.

The sailing time of Providence steamers to Norfolk, Va., is 36 hours, while the time of canal and lake transit, ocean to ocean, will be 28 hours; there will be 153 miles of summit travel at an elevation of 110 feet above sea level, while the Panama Canal has a latitude of 300 feet and is said to have 12 locks.

The Nicaragua Canal Construction Company estimated the cost of the canal at never less than $100,000,000. A United States government commission sent out two years ago, said $133,000,000, while an investigating engineer sent out by the *London Times*, places his estimate at $150,000,000, with the recommendation that the work be accomplished by some strong government, and not by a corporation. Suppose the latter estimate should prove to be correct, what does it matter when the great question in its broad entirety should be considered only, resulting in the greatest good for all.

The population of Nicaragua in 1890, consisted of 16,200 whites, 198,000 Indians, 1,800 Negroes, and 144,000 mixed, or about seven persons to the square mile, while Rhode Island had 318 and Massachusetts 269 persons.

It is one of the richest countries on the globe, and among its most valuable productions are the indigo plantations of Rivas, whose vats for soaking the plant, built of native limes, forming a hard, smooth concrete as old as the Spanish Conquest, dispelling the fear of volcanic eruption, of which there has been perfect freedom since its discovery.

The forests covering so large an area are an element of wealth, and with their present limited developments await the canal opening to obtain a general market. Their monarch tree, the mahogany, is abundant, growing to enormous size, frequently measuring from 40 to 50 feet in height below the first branches, and 9 to 12 feet in diameter at the base. Although it is appreciated for its beauty and for decorated work, it is also of value for ship building and other similar purposes; is better than oak, slow to take fire, free from dry rot, and does not suffer from any change of temperature. Messrs. Emery & Co. of Boston have large camps, and conduct extensive operations in Nicaragua mahogany.

Next in beauty and value is the cedar, well known from its use for pencils and cigar boxes. It is abundant, takes a high finish, and its aromatic odor preserves it from insects. The wild cotton tree, frequently 70 feet in height of trunk and 14 feet diameter, is lighter than pine, not quite as durable, is useful for building purposes, the making of canoes and barrels. Then comes lignum vitae, two varieties, black and green, rosewood, trees of the acacia family and many others, known as beautiful cabinet woods; oaks of several varieties, long leaved pine, dye woods, palms, etc.

The principal agricultural wealth lies in coffee plantations, rapidly increasing in number, one colony of foreigners in 1894 cultivating thousands of acres, their main obstacle being want of transportation, their roads not being practical for wagons or carts, necessitating carriage on the backs of mules.

The production of india rubber is decreasing from the wanton destruction of the trees, and unless some radical legislation is enacted, the industry will die out.

Bananas and sugar-cane are abundantly grown, and from the latter an English writer says "a very large quantity of the cane is used in the manufacture of a species of rum known as 'blanco,' a most terrible compound, but perhaps no worse than the villianous humbug spirits found everywhere."

Three crops of corn per year are grown, and tobacco, being

of good quality, can be cultivated to any desired extent; yams, sweet potatoes, bread fruit, cocoa-nut palm, brown beans, oranges, lemons, limes, citrons, shaddocks, pine apples, mangoes, and vegetables of the temperate zone grow well in the elevated districts, where cabbages, turnips, radishes, lettuce, egg plants and tomatoes can be raised with slight labor and care.

The mining laws are liberal, and although gold, silver, copper, tin, antimony, lead and other metals are found in many places quite rich, the terribly bad condition of the roads makes the introduction of machinery very difficult and costly, so that their machinery plants are of ancient construction, and of the most primitive character.

The Suez Canal, through which but four ships carrying the American flag passed in 1895, is a sea level canal, or open cut passage through a sandy country, and cost $115,000,000. This great and successful water-way is 87 miles long, 66 of which are canal and 21 of lake navigation, with a depth of 28 feet, without locks. Its tonnage in 1894 was 8,059,106. No comparison from an engineering standpoint can be made, yet the Suez Canal's greatest opponents were England's most noted engineers, who characterized it as a useless ditch for stagnant water, but not so after its completion, requiring six years of faithful labor.

At the present time, we are imformed, Rear Admiral WALKER and his party are about returning to this country. Their report will be favorable, and althought it will meet with opposition of a personal nature, under cover, it now becomes the duty of our Board of Trade, Chambers of Commerce, Business Men's Associations and Public Improvement Associations to familiarize themselves with all reliable data of this proposed water-way of 1502, and lend their voices, pens and presence to bring about its completion in 1905.

The PRESIDENT. The next paper on our programme is entitled "Cotton Mill Costs," by Mr. WILLIAM WHITTAM, JR. of Charlotte, N. C.

The SECRETARY. I beg to say that in accordance with a letter from Mr. WHITTAM I will read this paper by title only, as Mr. WHITTAM has written me that he desires that it should be so presented before the meeting and taken up for discussion at the next meeting, because it is not in print and consists very largely of tabulated material which had best be examined by the members in detail before consideration.

COTTON YARN MILL COSTS.

WILLIAM WHITTAM, JR., Charlotte, N. C.

Cotton manufacturing methods and details are today so developed that in so far as their fundamental principles and the machinery employed in the process are concerned the science may almost be said to be an exact one. That the mechanics of the various machines have received intelligent and persistent attention from numerous persons of developed mechanical knowledge, and who have perhaps devoted the best part of their time to the study of one or two particular machines, is demonstrated by the marvellous improvement in the minor details, especially those of shop construction that have been brought out within a comparatively recent period, some of which the writer had the pleasure of describing to you in the discussion of topical question No. 61 at the last meeting of the Association.*

Considering the exactness and the well established lines upon which the manipulation of the material is now carried on in a modern mill; the *inexactness* and lack of system in the way the cost of production is obtained by different individuals becomes all the more apparent.

There are possibly as many methods as there are men engaged in the business, varying from that of arbitrarily doubling the labor cost and assuming that this covers all other expenses, (except raw material) to that equally sensible (?) one of following the market and waiting until accounts are closed to discover the result.

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* Transactions New England Cotton Manufacturers' Association, volume 63, page 143.

In this paper a *system* is given for obtaining the cost of production of single and twisted yarns, and should it prove of sufficient interest to the members to create a desire to have the method carried through to the finished cloth, I will prepare a continuation of the paper for presentation at some future meeting.

The unit of productive capacity in a yarn mill is the spindle; the amount of possible production being modified by its speed and the number of turns per inch put in the yarn. A mill which has been organized with a proper knowledge of the limits of each machine in the process will have its preparatory machinery so balanced, both as to the number of machines of each kind and their speed, that if they all have such attention as to make them produce the number of pounds per week that they ought to, and will turn off with proper management, there will be no obnormal accumulation or scarcity of stock at any part of the process. Always assuming that the plant is arranged to produce some specified range of counts, and that this range is approximately adhered to. That the spinning spindle as the ultimate producer in a yarn mill should always be taken as the base from which the cost of production must be calculated in any correct costing method, is obvious, for if there be an accumulation of roving in the spinning room, no more yarn can be produced than could be spun, if the carding department should just keep up with the spinning department, and conversely; if there be a scarcity of roving in the latter department it is exactly equal to reducing the productive capacity of the mill by just so many spindles as would require to be stopped to keep the remainder constantly in operation, and the expense account would, therefore, be necessarily allocated to this diminished number of spindles.

Should a similar condition exist at any other point in preparatory processes the same method of allocating costs would for the same reason have to be adopted.

Mule spinning is taken in the examples given, for the reason that the weight per spindle that can be produced by this ma-

chine is a more complex calculation. That of the frame spindle being much more easily determined.

Some explanation of the method by which the productions shewn are arrived at is desirable and therefore given.

In Table I. the pounds per spindle that ought to be produced are given for a large range of numbers.

Horizontal lines are lettered to facilitate explanation.

The figures given in Table II. are intended only to show the method or system by which the results are obtained; and therefore cannot be considered as the exact cost of any particular establishment, they having been advisedly altered so that private information obtained while acting in a confidential capacity will not be divulged.

Considering Table I. the horizontal line *A* gives the constant number for twist or the number by which the square root of the counts has been multiplied to obtain the turns of twist per inch to be put into the yarn as shown in line *B*.

In line *C* the turns of the spindles per stretch or draw for the length of stretch given in line *G* are shewn.

The number of turns shewn indicates the number of revolutions of the spindles that would be necessary to put into each inch of the length of yarn per stretch given in line *G*, the number of turns shewn in line *B* plus the number of turns the spindle would make if it were revolving at its spinning speed for the number of seconds it loses in the operations of backing off and winding on, this number of seconds being shewn in line *H*, it is necessary to include the time thus lost expressed in spindle revolutions in order to obtain the number of stretches that a mule would make per week as shewn in line *D*.

It would of course be a much simpler plan to count the time consumed in making any number of draws, and from this calculate the production, but this method is not by any means always practical, for it is quite often necessary to name a price for yarns of a count not before produced or containing a specified and unusual number of turns per inch, and in such an event the proper

production *must be calculated* before an intelligent basis for fixing the selling price can be obtained.

The draws or stretches per week shewn in line *D* indicate — if the first vertical column marked 20s be taken as an example — the number of times 64 inches of yarn that would be produced per week if the mules did not stop for doffing, cleaning or any other purpose. This length is converted into hanks and shewn on line *J*, minus the length that would be lost by doffing, cleaning, etc., as shewn for each number, in terms of per cent. of total time worked in line *I*.

It should be explained here that the working hours for which the productions given in this table were calculated were only 55 per week, and also that the lengths of stretch given on line *G*, are one inch less than the actual length in each case, this deduction being made to cover production lost by broken ends, etc.

The meaning of line *F* is obvious.

In line *K* the hanks per spindle in line *J* are converted into pounds and decimals of pounds per spindle per week.

That the principle upon which these productions are found is a sound one, is proven by the fact that under the conditions shewn the weights per spindle given are very generally produced and often exceeded.

This also goes to prove that the percentages allowed for stops, broken ends, etc., are correct for all practical purposes.

Taking up the consideration of Table II in which the method of ascertaining the cost of production for various numbers is given, horizontal line *A* designates the kind of cotton used and and also shews whether it is carded or combed.

Only Egyptian and Sea Island stock was used in the particular mill for which this table was prepared.

It will be noticed that 30s is spun from an all carded preparation; 32s to 40s, both inclusive, from half carded and half combed roving, *i. e.*, one bobbin of carded roving and another of combed were run together in the mule creel. From 46s to 50s, both inclusive, were made from an all combed Egyptian prepara-

tion and number 60s from a better quality of the same class of cotton.

70s and upwards being spun from three grades of combed Sea Island stock, the grades are indicated by the differences in the cost of the cotton shewn on line *R*.

On line *B* is set down the hank roving from which the various counts are spun, double rowing being used for all the numbers given.

The entire productions per spindle on line *C* are transferred from Table I.

Referring to the first two vertical columns in the table under consideration, headed respectively "Annual amount of expense in dollars" and "Weekly expense per spindle in cents", it will be seen that in the first column the total of each sub-division of the yearly expense account is shewn; in most well managed mills the fixity of these items is almost absolute comparing one year with another, except in the case of one or perhaps two items.

In the second column these values are reduced to cents or fractions of cents per spindle per week.

In ascertaining the cost per pound of production of such labor as is actually producing from the opener to the slubber (line *D*) it will be noticed that the cost per pound for 30s is given as 1½ cents; considering this as an example it must be remembered that it is the almost universal practice to remunerate the operatives in these processes on a daily wage basis, and the same number of hands would usually be employed even if the average counts should be somewhat finer or coarser than the usual average, therefore the expense per unit of product of all yarns spun from the same preparation would be the same for these processes, consequently the cost at this point increases by preparations and not at each counts as is the case in the other items; the labor cost of the half carded and half combed preparation being one-half cent per pound higher than the whole carded yarns and an equal amount below that of the whole combed Egyptian preparations.

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	130 s	140 s
Hank Rove	22	22
Lbs. Per Spindle Per Week	0.11	0.099
Opener to Slubber	2.75	2.75
First Slubber Frame	.21	.21
Second Slubber Frame	.24	.24
Intermediate Frame	.47	.47
Jack Frame	1.60	1.60
Mule Frame	12.67	14.11
Overlooking and All Non-Producing Department Wor	4.82	5.36
General Work From Outside Department	2.28	2.53
Office and Management	1.18	1.32
Coal	2.82	3.13
Insurance Supplies and All Other Expenses	5.82	6.47
Interest	13.00	14.45
Depreciation	8.73	9.70
Total	56.59	62.34
Cost of Cotton	21.00	21.00
Waste	17.18	17.18
Total	94.77	100.52
Per Cent. of Waste*	45%	45%

*The waste percentages given here are assu

The work done in the processes given on lines *E*, *F*, *G* and *H* are paid for at piece work rates per hank, and from the number of spindles, per machine, and the price paid per frame per hank, the cost per pound is readily obtainable.

In obtaining the cost per pound for mule spinning (line *I*) the spinners piece work list is taken and to this is added the wages paid to piecer and back boy, resolved into cents per pound, by ascertaining the number of pounds per week, per pair of mules that would be spun, on the basis of the calculated productions per spindle per week given in line *C* and dividing the total weight thus obtained into the sum of the piecers and back-boy's weekly wages and the sum of this total and the price per pound paid for spinning will be the total cost per pound for this process. (The mules of this mill were of such a length as to require the services of a piecer in addition to those of a back-boy.)

The total non-productive wages paid is divided into two items (lines *J* and *K*) the first of these *J* "overlooking and all non-productive departmental work" includes all labor charges such as overseers, second hands, helpers, sweepers, laborers, elevator-men, etc., etc., resolved as is each of the subsequent divisions of expense, into cents per spindle per week; the next line (*K*) includes all outside labor charges except such as are accounted for on line *E*. The import of lines *L*, *M* and *N* is obvious.

The interest charge on line *O* is taken at six per centum per annum on an investment of one million dollars ($1,000,000.00) and that for depreciation (line *P*) at five per cent. on $800,000.-00 the difference between the two amounts representing the working capital.

It has been more than once asserted before the members of this Association that these two charges ought not to be included in the cost of production, and perhaps when capital can be secured for industrial investment with an assurance that no return is expected from it, and also when an establishment can be erected and maintained in its original state of efficiency without cost, these two charges may be reasonably and safely omitted

in calculating productive costs, but to most manufacturers these charges are quite as legitimate as are those of labor and supplies.

The totals of all expense charges are found on line *Q*, line *R* showing the cost per pound of the various grades of cotton used, landed at the mill, the waste made in each process being shewn in *value* on line *S*, and the total cost to produce the single yarn is given on line *T*. The percentage of waste from which the values on line *S* are obtained being stated on the last line of the table.

Table I is also used as a means of proving the productions of the mill either from week to week, or for any other period that may be desired.

In order to reduce the number of figures let it be assumed that the particular mill under consideration spun during a working week the weights of various numbers and twists given below, for example say:

20s.	21,412	lbs.	at	1.527	lbs.	per	spin.	per	week	requiring	14,022	spls.
40s.	6,123	"	"	0.672	"	"	"	"	"	"	7,112	"
60s.	4,864	"	"	0.395	"	"	"	"	"	"	12,315	"
80s.	6,328	"	"	0.231	"	"	"	"	"	"	22,520	"

And the following yarns with turns per inch obtained by multiplying the square root of the number by 3.75:

100s.	3,189	lbs.	at	0.173	lbs.	per	spin.	per	week	requiring	18,436	spin.
120s.	659	"	"	1.135	"	"	"	"	"	"	5,622	"
Tot.	42,675	"								Requiring a total of	82,027	"

The pounds per spindle per week for 20s, 40s, 60s and 80s, are taken from Table I., while those for 100s and 120s are calculated in the same manner.

It is evident that the total weight of yarn produced during the week could have been spun on 82,027 spindles, and since the total number of spindles in this mill is 84,000, there have practically been 1,973 spindles idle during the week for which a satisfactory explanation ought to be had.

It is therefore obvious that by this system a check is kept on the running of the machinery, efficiency of the help, and the management can at all times know if the machinery is being kept up to its productive capacity.

Subsidary departmental production and cost books can be used advantageously in conjunction with this method, by means of which both carding, spinning and twisting departments can be closely watched, and those in charge held strictly to account. Once properly arranged, such a system involves but little labor and a trifling expense and becomes almost automatic.

Similar and periodic reports can be readily compiled by having tables prepared of the weights that should be produced of all numbers, after the method explained in Table I., taking, say, the following twist constants:

2.50	Hosiery	twist.
2.75	Doubling	"
3.00	Special	"
3.25	Filling	"
3.50	Bastard	"
3.75	Mule warp	"
4.00	Extra warp and frame twist.	

A book is ruled for the purpose of keeping a record of the weights spun and the number of spindles that would with proper attention produce these weights. A page being kept for each twist constant; in other words, all yarns spun with hosiery twist would be entered on one page, yarns spun with doubling twist on another, and so on.

Referring again to line *I*, it will be found on examination that if the calculated productions for the different numbers are turned off by the spinner and these multiplied by the prices given as being paid for mule spinning, that if an equal amount (say $9) be deducted in each instance as the wages paid piecer and back boy, each spinner will earn about the same weekly wages, whatever counts he may be spinning.

PRODUCTIVE COST OF TWISTED YARNS.

Table III. gives the method adopted for obtaining the costs of twisted yarns, and is arranged on the same general principles as those of Table II.

For similar reasons to those given for taking mule spinning as an example in calculating the productions in the spinning department, the twisting of six cord spool cotton is taken as an illustration in Table III.

To obtain the weights that ought to be produced by a twisting frame doubling two or three ply, it is only necessary to know the counts of the resultant thread and the velocity and diameter of the front roll; or the spindle speed, turns per inch and counts of twisted yarn may be taken to obtain the result, or expressed in another way the twisting being performed at one operation, the calculated production can be ascertained by the same rule as is used when figuring that of the spinning frame.

On the other hand, in dealing with the twisting of six cords, in order to maintain the previous assertion, that the spindle must be taken as the unit of productive capacity, a somewhat more intricate method of obtaining the weight that ought to be produced is necessary; and in order to elucidate the method here employed, a brief description of the processes through which the yarns must pass is desirable.

In the first place, then, the single yarn is first taken to the "cop winder" where two threads are wound together on one spool, these spools are then transferred to a twister, usually named either "first twist" or "preparing" twister; the bobbins of two-ply from this frame are then taken to another winder or spooler and three strands of this two-ply yarn are wound side by side on a doubler, creel spool, this frame being known as a "re-winder". The spools from this frame are then placed in the creel of another twisting frame named either "second" or "finishing twister", where the three threads of previously twisted two-ply are again twisted producing a six cord thread.

It will be observed that each vertical column for the first three lines *(A, B, C)* is divided into two subsidary columns each sub-

47,016 Twisting Spindl

140 s

	P	F
Turns per inch,	38	29
Spindle Speed	17	5894
Production in lbs. per spindle at each process	6	.86
Production in lbs. per spindle for doubling pr	.199	

Cop Winding per lb., piece work	4.18
Doffing	.30
Twisting, per lb.	3.62
Re-Winding, piece work	3.00
Reeling, piece work	.84
Overlooking and all non-producing department	6.10
General Work from outside of department	1.64
Office and management	1.18
Coal	2.47
Insurance, Supplies and all other expenses	4.50
Interest	8.35
Depreciation	4.82
Total Expense	11.00
Yarn Price	10.52
Waste Values	8.74
Cost per lb. in cents	10.26

division being marked at the top with the letters P and F, respectively.

In each column marked P are given, on line A, the turns per inch put in the preparatory or first twist, on line B the spindle speed at this operation, and on line C the weight in pounds per spindle, per week, that ought to be produced. In each subsidary column marked F are given similar particulars for the second or finishing twisting process. On line D the two productions for each number given on C are merged into one.

In other words, assuming for a moment that it is possible to have *one spindle, running at the two different speeds shewn on C and producing both two and six-ply yarns, and also putting in the two different turns per inch given on A at the same time, this supposed spindle would then produce the weight of finished six cord thread per working week given on D*, after making suitable deductions for all stoppages.

An example will perhaps demonstrate this more clearly, and for this purpose the first number given, 32s, is taken. From the particulars given on A and B in each subsidary column, the results shewn on C are easily calculated.

The production of one preparing spindle being 1.84 pounds per week of 32/2, and that of finishing spindle 3.99 pounds of 32/6.

The first named spindle P being employed in producing two-ply thread for the second spindle F, it will require $\frac{3.99}{1.84} = 2.18\ P$ spindles to keep one F spindle in operation; now the production of one F spindle being 3.99 pounds of six ply, the number of spindles required to produce this weight will be $2.18\ P + 1\ F = 3.17$ spindles, and since this number of spindles produces 3.99 pounds, the "production in pounds per spindle for the doubling process" will therefore be $\frac{3.99}{3.17} = 1.259$ pounds per week as given on line D.

It is therefore proven that the impossible operation assumed can be reduced to figures that will give accurate results for costing purposes.

Should this explanation be sufficiently lucid the calculations for ascertaining the productions of 9, 12 or any other ply of harness twines may be quite easily made.

It must also be here stated that the *values* given as costs of production are not exact ones for the reasons given with reference to those of Table II.

This Table (III.) may also be made use of as a basis from which to prove the productive efficiency of the twisting department, by employing a departmental production book, drawn up and kept in the same way as that outlined in a general manner in the explanatory example dealing with this application of the spinning productions as subjoined to Table I.

From the productions in pounds per spindle on line *D*, the cost per pound can be easily obtained.

The processes given on lines *E*, *H* and *I*, being paid for on a piece work basis, it is only necessary to set down the price per pound paid to the operatives from the price lists.

Line *F* gives the cost per pound for doffing.

On line *G* some discrepancies will be noticed; for instance, 50s is given as costing more per pound to twist than either 60s or 70s, this being caused by peculiar local conditions existing in this mill.

Lines *J*, *K*, *L*, *M*, *N*, *O*, *P* and *Q* are calculated in exactly the same way as the corresponding items in Table II.

Line *R* being an assumed waste loss converted into values per pound, the total expense of the department for each number per pound being given on line *S*.

In conclusion the indulgence of the members is asked for any mistakes that may appear in the figures given, and owing to the very limited time at my disposal, I am afraid that many points might have been explained more clearly than they are, if opportunity could have been had for a careful revision.

It may also be said that this system can be employed in conjunction with a set of subsidary books, so arranged as to give an almost exact statement of the profit and loss account of the manufacturing department from week to week.

The PRESIDENT. The paper is a paper largely of figures, and I trust that you will examine it and be prepared to discuss it at the next meeting. In connection with that you might hunt up your old records and read the report of the committee on costs, and be prepared, perhaps, to more intelligently discuss that question than we did before.

The next paper on the list is "Early Inventions upon Copper Printing Rolls", by Col. SAMUEL WEBBER, of Charlestown, N. H.

EARLY INVENTIONS UPON COPPER PRINTING ROLLS.

SAMUEL WEBBER, Charlestown, N. H.

Some years ago, at a meeting in New York of the Society of Mechanical Engineers, in a discussion on the fatigue of metals, I mentioned the fact of the great inequalities that I found in copper rollers which had been used for a long time, and which had been turned down from an inch thickness of shell to about a quarter of an inch, and that it was very possible that these rollers were fatigued or strained by the long use they had been through. In the experiments to which I shall refer we used for the sake of convenience the light rollers, which are much more convenient to handle and wasted less copper. Mr. WOODBURY was present at the time and he recently asked me to prepare from my memory a little statement of the results of these experiments, which I have done.

It gives me pleasure to comply with the request of the Secretary and recall the discovery which made the engraving of copper rollers for calico printing, by etching with nitric acid, not only practicable, but profitable.

At the risk of being a little prolix and personal, I must go back to the time when, in 1841, I went to Lowell in search of employment, instigated by a strong mechanical taste which impelled me to seek some occupation in that line. I happened to arrive just at the time when the discoveries in electro-metallurgy had led Mr. J. D. PRINCE, the superintendent of the Merrimack Print Works, and Dr. S. L. DANA, the chemist, to turn their attention to the practicability of applying this electrical process to the engraving of the copper rollers, and through Dr. DANA, who was an old friend of my father's, I was at once employed

and set at work experimenting. There were two distinct lines of experiment open, one to deposit fresh copper on a surface which had been previously engraved in the usual machine by a "mill" which had been in turn raised from a "die": so as to fill the engraving, and when polished and printed to leave blank spots on the cloth, to receive some other color.

This was done by painting over the engraved roller (except the spaces to be left white) with an asphaltum varnish, then immersing it in a tank of sulphate of copper, and attaching it to the negative pole of a galvanic battery. An outer shell of copper, some two or three inches larger in diameter, was also lowered into the tank around the roller and attached to the positive pole, so as to take up the acid, set free by the electric current. The quantity of this current was indicated by a magnetic needle, hung over the conveying wires. It took some months to get the experience in handling the batteries, necessary to make them work properly, but we finally succeeded, and were able to deposit the copper in a satisfactory manner. Unfortunately, it would not stay fixed, the mechanical strain on the rollers in the printing machine worked the spots which had been deposited loose, and they all came off, so that we had to give up the project.

I have sometimes thought since, judging from later experience, that the trouble came from oil which had been forced into the copper in the previous "milling" process, and not chemically cleaned out.

The other project was to cover the roller entirely with a resistant asphaltum varnish, and cut the necessary lines and figures through this with a diamond point, and then placing the roller again in the etching tank, reverse the poles of the battery and eat out the figures so drawn, from the positive pole, depositing the copper on the outer shell. This was tried, but the operation was too slow, and we could not make a varnish which would resist the long soaking necessary for the operation of electrolysis, and we decided to then try the usual mode of etching by nitric acid, which was much quicker. While we were experimenting on this matter, Mr. MILTON D. WHIPPLE, the

well known inventor of the Whipple file machine and other useful devices, appeared on the scene with a project for a new engraving machine, which was to accomplish its object by the simultaneous use of a number of cutters or gravers, and thus reduce the cost of the operation. He knew nothing of the process in use, or of the improbability of keeping a dozen or twenty "gravers" working at once, of equal sharpness, and all cutting to the same depth over the surface of the copper roller, during the time required for the operation. Mr. PRINCE, however, saw the merit of his idea at once, and that it might be applied to a number of diamond points, and so draw many figures through the varnish at the same time, so as to cover the whole width of the roller at once, and then etch it all at one operation.

The Merrimack Company had in its shop an old and very massive machine, which had been built for the purpose of engraving the scroll work figures such as are seen on bank notes, and this was given Mr. WHIPPLE to experiment on. He soon dismantled it of most of its "tophamper", leaving only the carriage and ways, with the necessary gears, and applied a "diamond bar", on which could be placed any number of diamond points, at equal distances apart, all cutting at once, and the carriage being moved along as the lines were drawn, until the work done by one diamond point met that made by the preceding one.

With this we set to work, and in due time we succeeded in covering the rollers accurately with the needed lines, and in so arranging our acid bath (in a granite tank) as to etch the lines to the proper depth in from two to three minutes.

Then came another trouble: the work was not of even depth and did not print equally. The first thought was that the diamonds did not cut alike, and Mr. WHIPPLE got up a very perfect grinding machine, the precursor of some of the "drill grinders" of today, by which the different points were all ground to the same angle and to all appearances cut exactly alike. Still the work was imperfect, and Mr. WHIPPLE attributed it to imperfect etching varnish, and spent some time in endeavoring to

put it on to the rollers by machinery, instead of by hand, as had been the custom, but with no beneficial result.

Meanwhile the company had imported from England a light ruling machine, which would cover the whole surface of a roller very quickly with spiral parallel lines, drawn with one diamond, which when etched, printed diagonal "slashes" across the cloth. Mr. WHIPPLE soon made this automatic, so as to be driven by power, with the return motion and traverse of an "iron planer", so that we could rule a band of lines, a quarter of an inch wide, of a dozen separate lines, then skip the same distance and rule another band, until the roller was covered. This showed when printed a complete series of diagonal bands across the cloth, and was of such a sensitive character as to show the slightest inequality in the engraving. While we were in trouble with the uneven work I used this machine a great deal for experiment, as the lines being all drawn with the same diamond must be alike. We had spent many months on these experiments without success, and I had become disgusted with trying to put a more even coat of varnish on rollers, which I felt sure were as perfectly covered as a year's experience would enable me to do it. I had made up my own mind that the difficulty came from some other cause, and had suggested that it was probably due to some inequality in the copper, but was met with the assertion that that was impossible as the rollers were very carefully made.

One day, on getting an impression struck off from a roller which I had just etched, it seemed to me that I had seen a similar appearance before. A dark stripe, about three fingers wide, showed from near one edge of the cloth almost across it, and then bent down about the same distance very much like the head of a hammer. I then said to Mr. PRINCE, who was looking at it with me, and who had been very sure that it was in the varnish, that I believed I knew just what was the matter, and if I could have my own way for a week I thought I could solve the puzzle. He told me to do just what I pleased and take my own course about it.

I went straight over to the printing room, got the roller, and

brought it over to the engraving shop on my shoulder, had it turned off smooth, re-grounded, re-ruled and re-etched it, and got an impression which was an exact *fac simile* of the first one. Again I got the same roller, had it turned a second time, and then had the man who did the turning run a heavily weighted burnishing roller over it before polishing it.

I once more varnished, ruled and etched it, and the impression was perfect. Not a shade or cloud to be seen. Another roller gave a similar result — the impression was even and the question was solved. We had been fighting the unequal density of the copper, under false pretences, for many months, and the simple compression of the surfaces to the depth of $\frac{1}{100}$ of an inch to an equal density, had put an end to all our troubles. We also found that the rollers wore less and lasted longer in the printing machine.

From that day the etching process went on, as the saying is, "by leaps and bounds". WHIPPLE'S first multiple diamond ruling machine, driven by power, was set at work steadily on stripes and checks, all it could rule, and he turned his attention to the pantograph machine which would draw curved lines and all irregular figures. This he soon accomplished, and the successors of his machine as modified and improved by the Messrs. Hope of Providence, are now in use in all the print works in the country.

The financial results, to the Merrimack Company, were the reduction of the cost of engraving a copper roller to from one-half to one-tenth of what it had been, for many classes of work.

Whether Mr. WHIPPLE ever made anything out of it outside I never knew, but he afterwards built a pantograph for the Cocheco Company, while as an employe of the Merrimack Company I got nothing for my discovery, and after working for them for six years, seeing no prospect of any advancement in life, I left them and went down to Lawrence, to assist in organizing and building the Bay State Woolen Mills, where I remained three years, until my health failed me, and I went to Europe for a year's tour of observation.

Another machine, in which I had a hand at the same time, was the shear for trimming cotton cloth, now in universal use. Mr. PRINCE came up into our room one day and asked Mr. WHIPPLE if he could not invent a machine to shear cotton cloth, which would take off the knots not easily removed by the singeing process, and also cut out the wires from the loom pickers, which sometimes got woven into the cloth and indented the copper rollers. Now the wool shear has a rest on the under side, directly opposite the cutters, which holds the cloth up to the distance of its thickness, and allows the shear to trim off everything beyond that, and Mr. WHIPPLE thought that the cotton cloth was too thin to be handled in that way.

After Mr. PRINCE had gone, I asked Mr. WHIPPLE why he could not trust to the spring of the cloth, under tension, to keep it up to the cutters, he thought at first that it could not be done, but the next morning he had matured the plan by placing a rest bar under the cloth just before, and one just after the cutters, and drawing the cloth tightly over them. He made the lower or "ledger blade" very thin, and Mr. BURKE, of the Lowell Machine Shop, soon got up a perfect machine which went into general use. I do not know whether Mr. WHIPPLE ever reaped any benefit from it or not. I know I never did.

As we all are interested in electricity, I will say that there were other experiments made there in Lowell at the same time. Among the gentlemen there, the agents for the cotton mills and the professional men had a little club, which met around to eat oysters and discuss the topics of the day. Dr. DANA came to me one day and said they were to meet at his house the next week and he would like to present them with a little electric trophy to show what we were doing in our experiments. At his request I prepared a copper plate about two by four inches in size and etched upon it a rough picture of a plate of oysters on the half shell, with a pepper castor at one side and a vinegar cruet the other, and underneath some Latin motto, and gave the plate to Dr. DANA. He took it to HUGH O'NEIL, the old copper plate printer in Lowell, and had a number of copies printed which he

distributed among the club. Whether any are in existence or not I cannot say, but I can say that we succeeded in making the engraving by the operation of electricity on a copper plate made by electricity also.

The PRESIDENT. The next paper on our list is entitled "What I Don't Know About a Cotton Mill" by Mr. MALCOLM CAMPBELL, Woonsocket, R. I. I hope the gentlemen will be prepared to discuss Mr. CAMPBELL'S points or any other points that you don't know anything about. [Laughter.]

WHAT I DON'T KNOW ABOUT A COTTON MILL.

MALCOLM CAMPBELL, Woonsocket, R. I.

Before reading this paper I would like to explain that what I don't know on most subjects is, what I don't know having been but think should be done in the building and furnishing of a first-class mill.

MILL CONSTRUCTION.

The main building should not be over three stories high, with weaving shed connected by means of a fire-proof covered run, said run on hallway being located near the elevator. The shed should be at least twenty feet from the main mill, with a fire-proof wall for end, said wall projecting twelve inches thick at least three feet above the roof with wall caps made of iron or stone to protect it from the weather.

The shed should be constructed with a saw tooth roof for the purpose of diffusing light. The main building constructed on any of the well known plans, but I should prefer the Lockwood style of floor beams, with the exception that the intermediate beam be carried to the centre of double window frame and there supported by an I beam extending down to the window stool. This will give the beam a strong support and not in the least unsightly. I would advise the use of steel I beams. There would be no shrinkage in them to allow machinery or floors to settle, and the only objection I know of to their being used is, that they might sag in case of fire; but who would not rather run that risk, which is but a minimum with our well protected mills by first-class fire systems, than run the risk of shrinking beams and settling floors.

FIRE SYSTEMS.

We owe the credit of adoption to the manufacturers and the originating of the plans to Messrs. ATKINSON and WHITIN, who, if I remember correctly, were the first men to farther and push this great enterprise, saving the manufacturers thousands of dollars on insurance and also spurring them on to keep cleaner and better mills, as I do not consider that any factory should run that is not kept up to Manufacturers' Mutual Standard.

POWER.

The power house should be located convenient to the mill, also convenient to the railroad, so as to have the least amount of handling of coal. I would advocate the steam engine and electric generators as the prime movers and carry the power to motors in mill, the said motors to be located on the ceiling over the spare floor in the centre of the rooms in long mill, and at the ends in short mills; the motors located far enough below the ceiling to be handily oiled and operated. Each main line should have a separate motor and each long counter-shaft should also be driven by a separate motor, having all switches located on the wall, convenient so that the overseer or second-hand could operate easily in case of danger or accident, by the use of electricity. The extra heavy shafting, pulleys, and belting are all done away with and the fire risk reduced, as the power can be isolated from the main buildings.

PICKER ROOMS.

These rooms today, I think, have reached the standard of perfection and I strongly advocate the opening of cotton one week in advance before it reaches the feeders attached to the picking machinery. This opener should be connected by a short trunk, of not less than 10 feet or over 15 feet in length, to the first breaker. From breaker the cotton should pass to intermediate lapper by doubling four into one, thence to finisher with same amount of doubling. This will insure every time an even, clean lap, providing you have given the fans an ample dust room, with at least three square feet of outlet to each fan.

CARDING ROOM.

It is but six or eight short years ago that cotton manufacturers complained that first-class carding engines were not built in this country, but today there is no need of any such complaint, because the machinery manufacturers have built at a great expense to themselves a carding engine equal in all respects to any made in the world. Now, have the manufacturers of cotton done their part?

Stop and think for one minute! You buy an expensive and accurately made machine that is built to be adjusted to a few thousandths part of an inch and set it on a floor that will settle and give more or less each and every day with the weather. You expect this finely made machine to do good, accurate work. If you want good, first-class carding, set your carding engine on a foundation made as firm and solid as you make the foundation for your steam engine. You will then not only get extra good carding, but the repairs for your cards will be reduced to such a small amount that you will hardly know that you have any in your mill. Carding rooms should be located on the ground floor.

DRAWING FRAMES.

These machines, although the simplest machines in the mill, are about the most important and have given the machinery manufacturers no small amount of trouble and expense to perfect, but that has now passed over and a first-class machine may be had.

FLY FRAMES.

Fly frames should be located with cards and drawing and have *equally as good a foundation* to insure long life and smooth working with a small amount of horse power. I have now in mind a mill where the frames were set lengthwise with the floor beams, and in one year they settled, as also did the beams, one inch. This was in what is termed "a modern mill", built to see at how small a cost per spindle it could be done for, and *not to*

see how low the running cost could be made, which should be the all important factor.

In selecting a fly frame, care should be exercised to get one that will give the most even tension to the sliver, and look out for lost motion caused in the gearing by reverse of bobbin rail; also see that proper differential gearing, oiling arrangements, roll stands, cap bars, fine adjustments to cone belt traverse, etc., can be produced.

SPINNING FRAMES.

We have had at some of our late meetings very valuable papers read on the spinning frames, papers that great care and no expense had been spared to get them in proper shape, and they certainly were and are today of great value to the cotton manufacturers and a credit to their writers. But I think there has been and is today a great mistake made in the system of banding of these frames. I would advise the system used by all worsted mills on their frames, *i. e.*,—banding four spindles with one band by means of binder or idle pulley which swings on an arm hung on a rod under the frame near the cylinder. If this system was used, we would hear no more about slack twisted yarns, tight and loose band, weather effecting the bands, extra large amount of horse power consumed by bands being too tightly put on, tight bands in damp weather, complaints that the bands were put on too slack, *or to tight*, as I used to put them when working in the spinning room. To be sure, they were tight enough so I would not be sent for because the new band just put on had got too slack. I would advise the mill men of this country or any other to look well into this system of banding. The spinning room I would locate on second floor of mill and use the third floor for spooling, warpers, drawing-in, etc.

WHAT CAN BE SAVED BY REVAMPING MILLS HAVING OLD MACHINERY ?

Cost per pound in producing cotton goods is a question that largely interests every person connected with its manufacture,

and how to reduce the cost, and what will reduce it and how much, are the questions first talked over. Below I give the cost sheet of a mill that was revamped. In 1895 it was working with old and in 1898 with new machinery. I wish to call your attention to the fact that there was 11 per cent. allowance made on price of labor in favor of year 1895 so as to bring the cost to an equal price and not to show too radical an improvement, when part of it was due to cut-down in price of labor. This mill makes on an average 31.50 yarns from about a 4.25 hank roving.

Comparative Costs, No. 1 Mill, Periods in 1895 and 1898.

	Labor Cost Per Lb.		Supplies Per Lb.		Total Per Lb.	
	1895.	1898.	1895.	1898.	1895.	1898.
Carding,	.810	.596	.180	.052	.990	.648
Spinning,	1.257	1.046	.242	.168	1.499	1.214
Slashing,	.571	.499	.396	.259	.967	.758
Weaving,	3.303	2.646	.378	.453	3.681	3.099
Power,	.044	.142	.381	.289	.425	.431
Cloth-room,	.131	.159	.037	.037	.168	.196
Lighting,	.016	.000	.038	.021	.054	.021
Miscellaneous,	.032	.013	.798	.258	.830	.271
Office and Supt.,	1.022	.763	.000	.006	1.022	.769

The total cost for everything was, for 1895,	$8.75
" 1898,	6.99
	$1.76

You will note that the actual saving in labor was 1.76 cents per pound or about 20 per cent.

Following this you will find figures given by another mill where only the fly frames were put in new. I would like to state here that for two years the treasurer of this company questioned if it would be a paying investment for him to throw out his old frames, as he could not save anything by having less help in his card-room, but today he only wonders that he delayed the matter so long.

OLD PRODUCTION.	NEW PRODUCTION.
12,500—58 hours.	14,000—58 hours.
Hank roving, 4.16.	New, 4.70.
Card room cost, $1\frac{2}{10}$.	Card room cost, .94.
Number of yarn, 28.	Number of yarn, 30.

Breaking strain showed a gain of 12 per cent. The above figures show a fair comparison of what may be done by changing over old mills and it is only a wonder to me that the matter is taken hold of so slowly.

The PRESIDENT. Gentlemen, you have listened to the paper as read by Mr. CAMPBELL. You see what he is finding fault about in our mills. What shall we say about it? Mr. MESSENGER, I will ask you first. What do you say to these points raised by Mr. CAMPBELL?

Mr. FRANK M. MESSENGER. I think Mr. CAMPBELL'S is a very valuable paper. I would criticize a little the idea of placing the spooling on a separate floor from the spinning. My reasons are these. In one of the mills that we recently remodeled, we have just been to a little expense in getting spinning and spooling on the same floor and have saved quite an item in labor cost by doing so. Possibly other mills handle their yarn differently from what we do and in that case the rule might not apply, but it saves the counting, measuring and weighing of the yarn to have it pass directly to the spoolers. I think it would be hardly as well to have the spoolers on a separate floor from the spinning, I prefer to have the spooling and spinning together.

The PRESIDENT. He brings up a question of construction here. I suppose he means the use of intermediate beams, by

what is known as the Lockwood plan, rather than one beam and very thick plank. What is your experience in that regard?

Mr. FRANK M. MESSENGER. Intermediate beams?

The PRESIDENT. Yes, I suppose he refers to putting in an intermediate beam and not quite as heavy plank.

Mr. FRANK M. MESSENGER. I have had no experience with that. Our new construction has been with nine foot bays, four inch plank and one inch top floor. I have an idea, that in the matter of steel beams, in spite of the opposition the insurance people make, it is something we will have to come to later.

The PRESIDENT. That is, when intermediate beams are used?

Mr. FRANK M. MESSENGER. Yes, I think the point very well taken regarding rigidity of floors. I think that a machine will do its work better, run at a higher rate of speed, save repairs, and in every respect do better with the steel beam construction, although I have not had experience with it. It is my impression that it would be a great improvement over any floor construction we have yet used or are using generally today, especially for carding.

When we put in our revolving flat cards we set them on the second floor. We had 12 x 16 inch hard pine beams. This was an old mill, but we put in a new floor, and the floor beams were new. The floor was four inch plank and an inch of maple on top of that. The bays were only eight feet apart. The mill was built in 1862 and it was not a wide mill, only about 63 feet wide, so that the spans were not long, less than 22 feet. In setting up the cards after we put the cylinders into the frames, those floor beams, although of well seasoned lumber, sagged nearly an inch. We immediately changed our plans and moved the cards down on the lower, first floor. There was a cellar under that and we put in intermediate piers, and it was a great improvement; and notwithstanding

this, our carder has re-leveled several of the cards since they were put in three years ago, he thought he could get a better adjustment. I believe in a stiffer floor than we have yet been using particularly for revolving flat cards and I don't think it would be an injury to any of the machinery we run.

The PRESIDENT. We would like to hear from any member on the point brought up by Mr. CAMPBELL. Mr. LAWTON, tell us what you think about a proper floor construction for heavy machinery.

Mr. HAROLD LAWTON. I can't say that I am very familiar with Mr. CAMPBELL'S construction. It is not new construction at all; it has been in practice on the other side of the water for a good many years, and most of the mills are constructed after that style. I think Mr. MESSENGER'S plan is all right.

Mr. O. B. PARKER. I believe the Berkshire Mills at North Adams is constructed with steel floor beams. I think, also, the floor is further stiffened by placing on the steel floor beams Southern pine lumber crosswise, the same direction that you would lay the plank on the ordinary beam, and then the plank and flooring placed top of these secondary beams. This floor, I am told, is exceedingly stiff and particularly well adapted for the placing of machinery. I am not quite sure that that is the way I should care to build a floor, neither do I think as Mr. CAMPBELL has suggested, that I would build a floor of the Lockwood construction. I believe there are too many joints in that construction. I think that it is more apt to settle and shrink and bring machinery out of level and out of line. I think also that machinery placed crosswise of a mill is more apt to get out of level and line than it is placed the other way, especially the fly frame or spinning frame. You bring the bearing of the machine itself alternately upon the beams that it reaches over, whereas, placing it the other way, you are pretty apt to get it between the beams, and the floor plank will sag and make an uneven condition for the running of the frame.

Regarding the capping of walls, when above the roof. That is, perhaps some of you know, quite an open question, and the capping of walls has given more or less trouble. I have found that the best kind of capping is cast iron, with a male and female groove, if you may so term it, at the end of the capping, so that one piece will fit over the other and make a water-tight joint. Then the side of the capping should run down over the wall far enough and have a sharp corner on it, sharp enough so that you can carry the water away from the wall. Stone capping laid on a wall in cement will not stay there. The frost in winter in this climate will gradually move it and get it out of shape and make joints and the water is sure to get in.

The PRESIDENT. Have you anything to say in regard to banding, Mr. DRAPER, from your experience?

Mr. GEORGE OTIS DRAPER. I have had no experience with methods of banding of the kind Mr. CAMPBELL suggests at all; nothing of that nature.

The PRESIDENT. Your experience shows quite a loss of power though, by the ordinary banding, does it not?

Mr. GEORGE OTIS DRAPER. Certainly, there is the greatest chance for waste of power on a spinning frame in the banding. My experiences have been with different kinds of bands, or different weights of bands, but nothing of the different systems of banding with idle pulleys or anything of that kind.

The PRESIDENT. What do you suppose is the best way to stop it, to save that power?

Mr. GEORGE OTIS DRAPER. Well, the best way I have made up in my own mind, after reading of the experiments of other people and from what I have found for myself, is in using a very light band, so that the boy cannot pull them too tight or he will break them. I think Mr. ADAMS, in his paper—I think two meetings ago — gave his experience with a band which at the weight given was very light compared with what is generally

used, and I think the experiments in that direction would be of great benefit. If you use a very light band the boy certainly cannot tie it very tight in the first place, and being of smaller section it is less liable to change from the temperature or moisture in the room.

The PRESIDENT. You think at present the tension on the band is only dependent on the strength of the band and the size of the boy.

Mr. GEORGE OTIS DRAPER. Well, that has considerable to do with it.

Mr. MALCOLM CAMPBELL. Why wouldn't it be better to get a smaller boy? [Laughter.]

Mr. JOSHUA GARSED. There is such a thing as having a foundation too rigid. Having had occasion to move some thirty speeders a short time since, we put them in a one-story shed and each machine was put on a stone foundation, that is to say, a stone flag about four inches thick and three feet long, and width to suit the sampson except at the driving end. The flag or stone was wide enough to take the driving end and first sampson; the stones were embedded in what is known here as bar sand, well rammed and leveled before the machine was erected. Now, after running these machines a few months, we found the repairs were great and came to the conclusion they were too rigid. We then placed a thin strip of wood or a piece of leather under the driving end and each sampson, which seemed to remedy all the trouble, or in fact we thought so at the time, as our repairs were reduced to a minimum.

In answer to the question of the President to Mr. DRAPER, asking about what experiments had been made in driving of ring spinning with different kinds of bands. I remarked I had some little experience in driving ring spindles with one-inch endless leather belt. We removed the tin cylinder from the frame and put in a short shaft, about eighteen inches long, as all the driving on this frame was from the belt end, therefore

we did not have to transmit the power through the entire frame. On the shaft we had two pulleys about twelve inches in diameter with flanges on each side, one and a quarter inches between the flanges. We had two binder pulleys so as to get as much bearing or grip on the driving pulley as possible. On the spindles was a small whirl or pulley three-quarter inches in diameter and one inch wide; about every sixth spindle had a carrier pulley three inches in diameter, and a flange on the bottom to keep the belt in its place. Now, the only depression this driving belt had was the thickness of the belt, as the face of the whirls on the spindles was in line with the face of the depression or idler pulleys. The idler pulleys were all self-oiling. This frame ran for a long while and gave very satisfactory results. If I were buying new frames today, I would make some minor changes and give the above driving a practical test in the mill, where the machinery generally gets abused. In relation to the forty-inch traveling flat card, I made the remark, what became of the sliver on each end of the doffer? I would like to have had some of the members of the Association take up this subject and ventilate it. We all know that the doffing comb doffs the centre and each end of the doffer at the same time, and as the nip of the calender rollers is about eight inches from the centre or face of the doffer, there must be a stretch in the centre or a gather or curl up on the outer edges of the sliver. I made a suggestion to overcome this by putting two doffing combs on a card about three inches from centre to centre, the bottom comb blade to go only half way across the doffer and take a twenty-inch sliver off; the top comb to go the whole length of doffer and take the other twenty-inch sliver off; two coilers to each card, one on the right and one on the left hand side of the card. The above arrangement would make better and more even work and would put twice as much length in a can, which would reduce the piecings on the drawing frames one-half, and as piecings generally make bad work, complaints would be fewer.

The PRESIDENT. Is there anything else to be said in the line of Mr. CAMPBELL'S paper? If not, we will revert to our topical questions. Is there anything to be said on No. 94, What is the best method of treating belts, and their proper care? Or No. 95, What is the best method of utilizing the waste products of a mill? Or No. 96, In which class of machinery, as at present running, is it desirable to improve the most to obtain a minimum cost in manufacturing?

Mr. O. B. PARKER. The carding room wants to have the very best handling that can be given and you will get good results in your weaving, but if you cut down expenses in the card room you are going to feel it in your weave room. I think it is poor economy to start in with the card room. Of course I am a carder.

The PRESIDENT. Is it your idea that the weave room is the place to look for saving?

Mr. O. B. PARKER. I think that there is where you will get your saving; if you don't make good work in the carding you can't make it anywhere else. It has got to be just as good as you can make it, and then you can't make it any too good.

The PRESIDENT. Is there anything else to be said under No. 96?

Mr. FRANK M. MESSENGER. It seems to me that if I had a family of four, and the cost of supporting one was about as much as for all the rest, that would be the one I should want to tackle if I wished to reduce expenses; and as the cost of weaving is a very large part of the cost of manufacturing, it looks to me as if that was the vital point for us to tackle today.

The PRESIDENT. And yet, gentlemen, when we had this paper read about this loom today, we couldn't get one of you to talk about it. Is there anything else under No. 96? If not, we will take up No. 97, What is the best method of cleaning mill windows?

The SECRETARY. Mr. President, I have received a letter from Mr. HERBERT L. MOODY of the Bolles' Revolving Sash Company of New York, which with its enclosures describes the sash made by this company in which the peculiarity is that the vertical sides of the sash are divided from the portion that runs in the groove of the window frame, and ordinarily held in position by a semi-circular tongue and groove. An arrangement of springs fills the complete space of the sash in the window frame, and the sash can be turned on a horizontal axis by means of a pivot to each side at the middle, so that the sash can be inclined for ventilation, or reversed for cleaning the outer surface of the glass while standing on the inside of the room.

It has been applied to many office buildings, most of which are in New York City or vicinity. It is claimed that there is a great advantage in affording a means for ventilation suited to the desires of a person occupying a room near the windows, and that the hazard of cleaning the outside of windows is eliminated, also that the saving in labor, owing to the facility with which the work is done under the greater advantages, is sufficient to pay for the cost of the improvement in between two and three years. The additional expense for windows in factories would be from $2.00 to $2.50 a window.

The full description, with illustrations, will be on file at the headquarters of the Association, in case any of the members desire to investigate the matter in further detail.

The PRESIDENT. No. 98, What advantages does an electric motor possess over a transmission dynamometer for measuring the power required to drive textile machinery? I will say that we are hoping at another meeting, if possible, to have a paper from Mr. PAINE, and I was expecting that Mr. PAINE would be with us today. I understand that he is busy doing his spring

planting and that it will be impossible for him to be here, and is Mr. TOWNLEY of the Westinghouse Electric Manufacturing Company present?

The SECRETARY. The spring planting which is being done by Mr. SIDNEY B. PAINE is the planting of mines at the mouth of Boston Harbor, and the germinating of them, if occasion calls for it, will be quicker than any farmer ever saw. Mr. PAINE is the second executive officer of the Volunteer Electric Corps, and they are putting mines on the New England coast from Boston Harbor north, and I only hope that none of our own ships run against them; but Mr. PAINE promises a paper on the subject for the autumn meeting. Mr. E. B. RAYMOND of the General Electric Company was unable to be present, but has sent his paper on the discussion of this topical question. [Paper read by Secretary.]

Mr. E. B. RAYMOND. The necessity for measuring the power absorbed by any piece of machinery or group of such pieces is apparent to anyone. To the owner of the apparatus it places information at his disposal whereby the economy of his arrangement can be known, so that an unknown or unnecessary loss of power can be corrected. Besides this, in making a purchase of a certain type of a machine or checking up guarantees in connection with a piece of apparatus, a method of economically, accurately and easily measuring the power absorbed by such apparatus is most essential. To make such a measurement it is not always convenient nor perhaps satisfactory to have an outside engineer apply some form of transmission dynamometer which requires ordinarily long practice for successful operation and considerable trouble and perhaps expense in the setting up in addition to that of the actual experiment. Furthermore, every engineer is familiar with the error that can get into a dynamometer measurement irrespective of the accuracy of the instrument itself.

How much simpler and more direct is it to use an electric

motor as a transmission dynamometer. All one has to do is to belt the motor to the piece of apparatus of which the driving power is desired, adjust the speed, read an ammeter and a voltmeter and the horse power is obtained. The readings taken are so simple that nothing but gross carelessness can cause error. Further than this the very motor which is used to measuse the power also furnishes it. Consider, for instance, a spinning frame, taking say, six horse power. Belt up to the frame a six horse power motor, adjust the speed to the desired amount and start the spindles. When the frame is running under the conditions desired, read simultaneously an ammeter and a voltmeter, multiply the two readings together to get the input, and then multiply the result by the efficiency of the motor and divide by 746 and you have the horse power absorbed by the machine. An ammeter is as easy to read as a steam gauge, in fact, it is somewhat similar in appearance to it and is reliable to within one-tenth of one per cent., as also is a voltmeter. What then could be more accurate, more easily applied or more satisfactory?

Now as to the determination of the efficiency of a direct current motor for example. There are two methods, one called the "stray power" method, most useful when only one motor is at hand and which I shall describe first. It consists in measuring all the losses that exist in the motor, which being known, of course the efficiency can be immediately deduced. These losses are as follows:

First, the core loss, which is a loss in the iron core of the armature (or revolving part), due to molecular friction in the iron resulting from the necessary reversal of the magnetism as the armature revolves in front of the pole pieces—for a motor, as you know, consists primarily of a stationary magnet and an iron core or armature which is caused to revolve by the reaction between the current in the wires on the same and the field of the stationary magnet.

Second, the loss in the heating of the armature conductors due to the passage of the current through same.

Third, the loss in the heating of the field copper, as the sta-

tionary magnet is produced by a current of electricity passing through a coil of wire around it.

Finally, the loss due to friction and windage.

The core loss or molecular iron loss in horse power can be measured simultaneously with the friction by measuring amperes in armature, taken by the motor running free, and the voltage on same for proper speed and multiplying these two readings together and dividing the result by 746, the field during the reading being normally excited. For instance, if the armature of the motor under such conditions took 14.9 amperes as read on an ammeter at 100 volts as read on a voltmeter the horse power lost in molecular friction and mechanical friction would be $\frac{100 \times 14.9}{746} = 2$ horse power assuming the loss in armature conductors to be negligible as is usually the case at no load.

The loss in the heat due to the passage of current through the armature is equal to the square of this current multiplied by the resistance of the circuit. If C is the current and R the resistance, the loss in horse power $= \frac{C^2 R}{746}$. The resistance of armature is obtained by holding it stationary and passing a small current through, reading the volts at the brushes and the amperes simultaneously. The resistance is then equal to the volts as read divided by the amperes; or if A = amperes and V = volts and R = resistance, $R = \frac{V}{A}$. The field resistance is similarly measured. Hence the losses in a motor are equal to core loss + $C^2 R$. armature + friction (all of which exist in the revolving part) + $C^2 R$. field which exist in the stationary part. All these values can be quickly and easily measured and hence the efficiency can be calculated, knowing the input and the losses.

The second method of obtaining the efficiency of a motor is simpler and needs less calculation but requires two similar motors. It consists in belting two motors together, using one as a motor to drive the other as a generator. The input of the motor is measured as described above by reading the amperes input with an ammeter and the volts applied by a voltmeter

and the output by reading the volts and amperes from the generator. The square root of the ratio of volts multiplied by amperes output to volts multiplied by amperes input gives with enough closeness near full load the efficiency. If, however, a complete efficiency curve is desired, the square root method of calculating should not be used as the load on the motor is more necessarily than on the generator, since it supplies the losses of the system, and hence the motor and generator are not running at the same load and on lighter loads the efficiency varies with load. The method of calculating the efficiency at any input, then, is to substract from the product of input amperes and volts the product of output amperes and volts existing simultaneously at the generator. The difference divided by 746 is the horse power dissipated due to all losses in the system.

The losses in the system are: core loss of motor, core loss of generator, copper loss of motor armature, copper loss of motor field, copper loss of generator armature, copper loss of generator field, friction of belt, air and bearings.

The copper losses can be figured as indicated in "stray power" method above. Hence the remainder must be core losses and friction of motor and generator.

If the motor and generator are alike, one-half the remainder will be core loss and friction of the motor, since core loss is practically constant at all loads. If to this are added the copper losses of the motor the total losses of the motor are summed up and immediately the efficiency at the load in question is obtained. So in this way the efficiency at any input can be obtained and the output figured by a simple multiplication. This method has the advantage that the efficiency includes the losses in the belt and the extra loss in the bearings, due to the pull on the belt and where two machines are available is a most satisfactory method. You will always find, however, that the two methods give results closely agreeing.

It can thus be seen that an electric motor possesses every advantage for measuring power with a refinement in accuracy and convenience of application that nothing else can approach

and has demonstrated its reliability to a fraction of 1 per cent. There are special instruments, such as wattmeters, which read the products of amperes and volts directly on the scale, so that the input of the motor is obtained by a single reading as easily as the indication of a steam gauge. It can be stated with perfect safety that measurements such as have been indicated can be checked within one-quarter of 1 per cent. without the least difficulty, and it can thus be seen that anyone possessing a motor, a voltmeter and an ammeter, possesses a transmission dynamometer unexcelled in accuracy and simplicity.

The SECRETARY. A like misfortune governed the movements of Mr. CALVERT TOWNLEY, manager of the Westinghouse Electric and Manufacturing Company at Boston, and as he was unable to attend this session, I will read the paper in his absence.

Mr. CALVERT TOWNLEY. Practically all forms of transmission dynamometers depend on the diversion or deflection of some part of a train of transmitting mechanism, which deflection varies, in accordance with a known law, proportionately to the power transmitted, and by means of a suitable indicating or recording device, such amount of power is made known. Whether it be from distrust of the accuracy of these devices or from complexity of the adjustments necessary to secure good results, there appears to be a prevalent and well defined objection among mill men and engineers to the use of these devices wherever it can be avoided, and in considering the question of the consumption of power by textile as well as other machinery, we are continually confronted with the fact that this power has never been measured, and that the operator's knowledge of the amount and distribution of his power is limited to that obtained by indicating his engines and calculating the general distribution roughly by the speeds and width of his belts, which is, of course, at best, only approximate, and gives no indication of the distribution of power between counter-shafting and the machinery which does useful work. In the rapidly increasing use of elec-

tric motors in mills and factories of all kinds, the question of sub-dividing the power becomes a vital one and requires immediate solution. It is necessary to know definitely whether a certain number of machines actually require for their operation 30, 40 or 50 horse power, and it is possible to effect very large savings in the cost of power as well as in the cost of the electrical apparatus furnishing it, by accurate determinations of this distribution. This determination by means of an electric motor is simple, immediate and accurate within the closest desirable range.

The use of an electric motor pre-supposes that the electric current is available, and is therefore limited to such mills as either have electric plants of their own installed or are located in the neighborhood of a central station or other electric plant which will supply them current for testing purposes. Current being available, however, measurements of power consumed may be readily and quickly made. For example, a motor of suitable capacity may be mounted on a stout hand truck, such as is used to haul bales or other freight about the mill. On the same truck are placed electrical measuring instruments. The truck is then wheeled to any part of the mill and the motor belted to the machine or shafting, the power consumed by which it is desired to measure. This machine or shafting is then driven wholly by this motor and the energy consumed read off from or recorded by the electrical instruments on the truck. Connections from the motor to the wiring at different points may be made by flexible cable of moderate length with very little trouble. It is possible to determine the characteristics of efficiency, etc., of the motor with great accuracy under all conditions of load; in fact, such determinations are usually made at the factory before the motor is sent out and can be furnished by the makers thereof on application. These characteristics can at any time be checked, as far as they affect the results of measurements to be made, by throwing off the belt, running the motor light and taking note from the instruments mounted with it on the truck.

If the determinations of power consumed are made with a view of introducing an electric drive, the motor used in testing is afterwards available for a part of the system, and its purchase entails no additional expense for testing apparatus.

It may not be out of place to say here that the saving in coal consumed by an engine running an electric generator and distributing power throughout a large mill by means of motors of various sizes suitably placed in the different departments, has been found to be from 10 to 60 per cent. over that required to operate the same machinery driven by belts or ropes and long counter-shafting. The electric motor has therefore invaded the field of what we may term the local distribution of power as well as having taken a most prominent position in the transmission of power over long distances, as is required where the energy of a waterfall is utilized for industrial purposes miles away. Its applications are most varied and interesting, that of serving in place of a transmission dynamometer being only one of a great many.

The Secretary read topical question No. 99, What is the best taper or length of wind for mule cops on No. 37 filling?

Discussion postponed until the next meeting.

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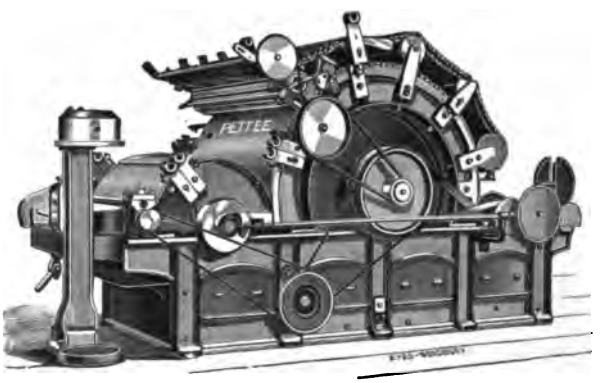

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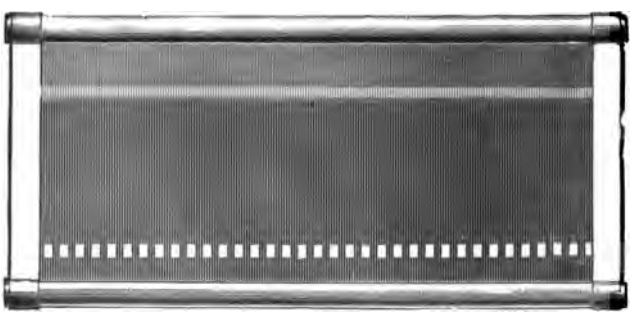

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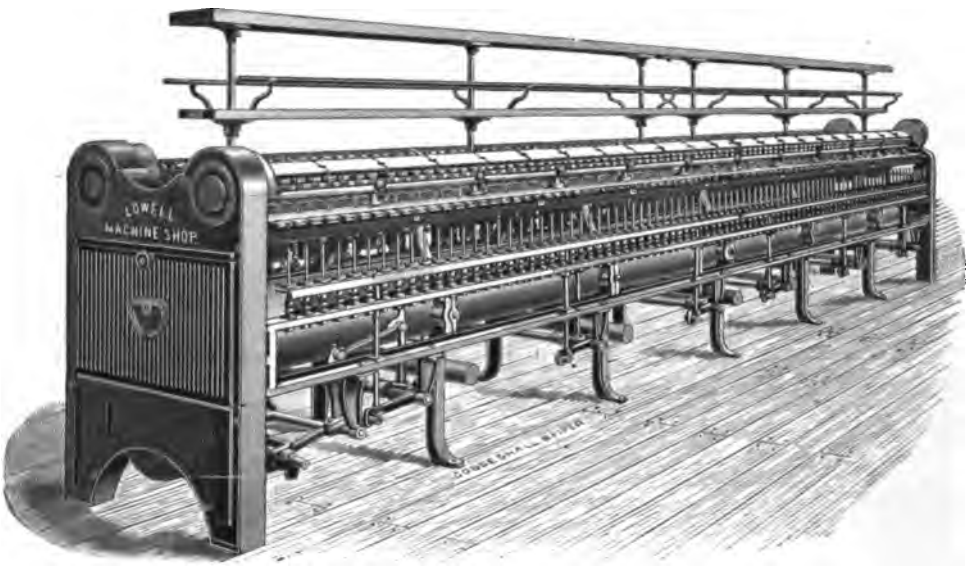

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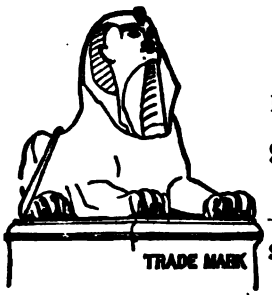

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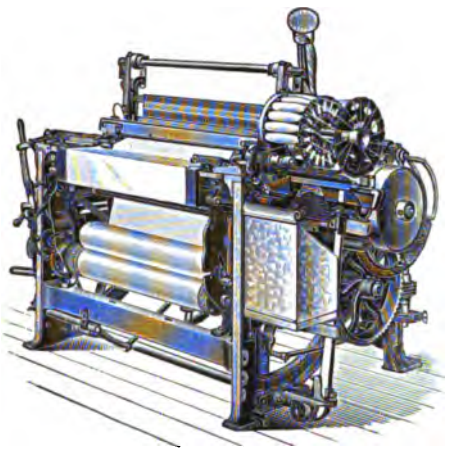

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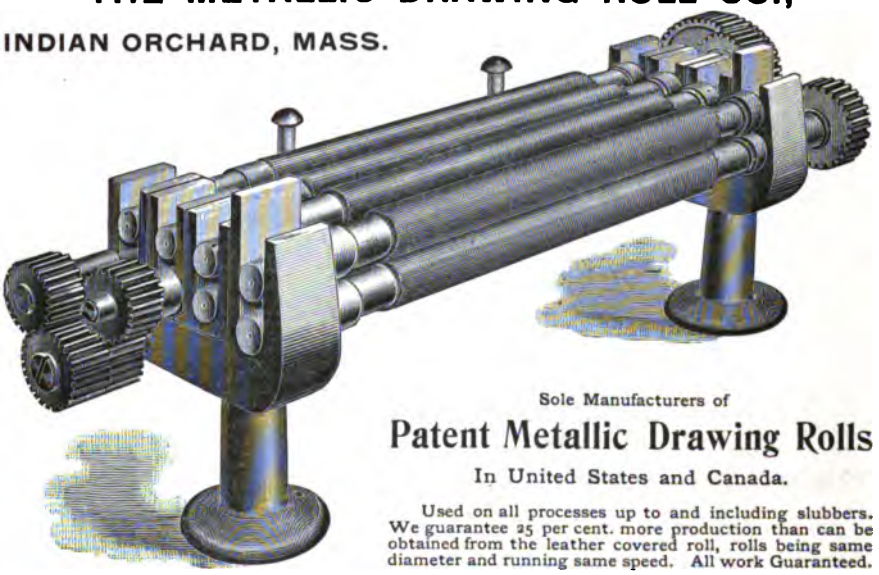

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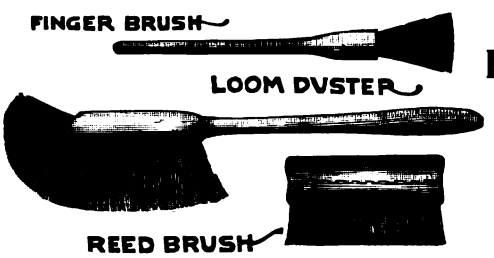

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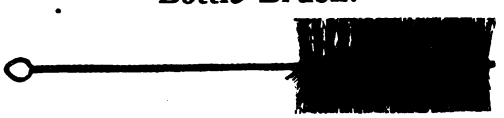

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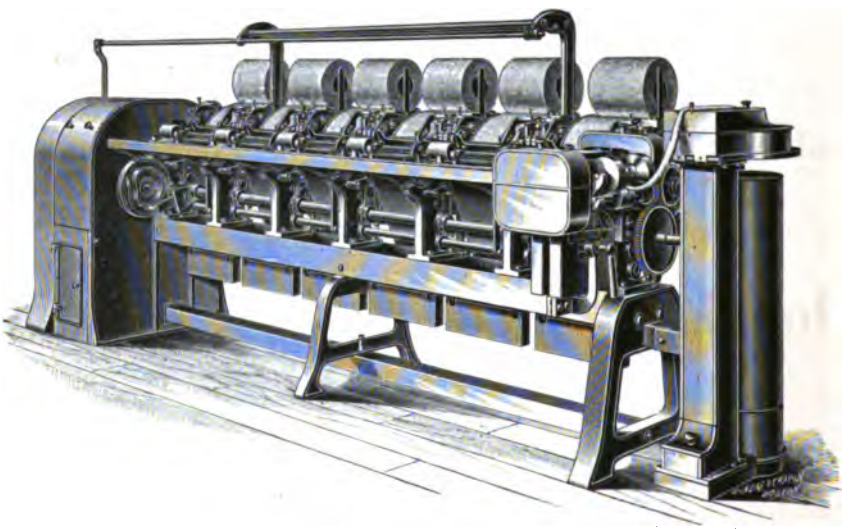

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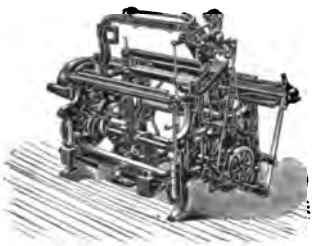

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